INDUSTRIAL HYGIENE PROBLEMS in BOLIVIA, PERU and CHILE

Federal Security Agency • PUBLIC HEALTH SERVICE

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by J. J. BLOOMFIELD
SANITARY ENGINEER DIRECTOR
Assistant Chief
DIVISION OF INDUSTRIAL HYGIENE
BUREAU OF STATES SERVICES

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Preface

The United States for many years has been active in the conduct of industrial hygiene activities. Many visitors come from foreign shores every year to study American practices, both in industry and government. Our close working relationships with our South American neighbors have enabled us to render a further service to them in the detail of staff personnel, and the following report describes the studies of Sanitary Engineer Director J. J. Bloomfield, Assistant Chief of the Division of Industrial Hygiene, Public Health Service, in Bolivia, Peru, and Chile. The studies were undertaken, and the recommendations made, at the request of the governments of these countries under the auspices of the Institute of Inter-American Affairs.

This report does not purport to be a typical industrial hygiene study, establishing principles and recommendations that may be equally applicable elsewhere. It includes a wide sweep of considerations—such as various socioeconomic factors—which an industrial hygiene study per se normally would not encompass. It also ventures into fields outside of the province of the Public Health Service. The promulgation and enforcement of codes, such as that drawn up for Bolivia, for instance, is traditionally a function of departments of labor or industrial commissions in the United States.

Faced with the task of developing effective industrial hygiene programs in Bolivia, Peru, and Chile, our consultant considered all factors and measures which were required to formulate a meaningful whole. Because of the critical prevalence of disease in these countries, for example, any efforts directed at improving the working environment without looking at the community scene would have been doomed to sterility. It must therefore be borne in mind that this unusually comprehensive study does not set up a model program for general use but is rather intended to cover only the situations in Bolivia, Peru, and Chile. Based on a thorough investigation of all aspects of industrial life in those countries, it represents an effort to help them develop their rich natural resources by promoting and preserving a most vital asset, the health of their working people.

J. G. Townsend, *Medical Director,*
Chief, Division of Industrial Hygiene, Public Health Service

Acknowledgments

Grateful acknowledgment is made to the Health and Sanitation Division of the Institute of Inter-American Affairs, under whose auspices these industrial hygiene studies originally were made possible. We are also indebted to government officials in Bolivia, Peru, and Chile for their cooperation in the conduct of the survey and to management officials for making their facilities available as study subjects.

Invaluable assistance toward the completion of this work was contributed by Public Health Analyst Victoria Trasko, of the Division of Industrial Hygiene, Public Health Service, who made the statistical analyses of the survey data and prepared the tabulations, and by staff Information Specialists Frances Balgley and Tula Salpas, who aided in the editing, organizing, and presentation of the report.

I. Introduction

Unlike the feverish exploitation of the Klondike, the development of South America's rich natural resources has been marked by a slow, steady tempo. Through centuries of effort, it has achieved distinction in certain fields, but some of its economic possibilities still lie dormant, while others are just now being aroused from their lethargy.

This pace is mirrored in the debilitated activity of its workers, for the serious prevalence of disease saps them of vitality and productivity. Another factor to which this low-gear development schedule is in part attributable is the lack of a vigorous immigration program. Immigration, which pumps fresh blood into a nation's lifeline, consists of a mere trickle in Bolivia, Peru, and Chile. Both these factors militate against the full tapping of the vast store of natural resources in the three countries. The lack of an adequate public health program particularly impedes progress. Only by a betterment of general living conditions will their productive capacity and purchasing power increase.

Toward this end, studies of industrial hygiene problems and conditions were undertaken at the request of the governments of Bolivia, Peru, and Chile to recommend ways and means of ameliorating the health status of workers. Since these studies—and the resultant recommendations—were made possible under the auspices of the Division of Health and Sanitation of the Institute of Inter-American Affairs, a brief description of the origin and work of this division is indicated.

ACTIVITIES OF THE DIVISION OF HEALTH AND SANITATION, IIAA

The health and sanitation program of the Institute of Inter-American Affairs, a Federal agency of the United States, was born in Rio de Janeiro in January 1942, at the Third Meeting of the Ministers of Foreign Affairs for the American Republics. It sprang out of resolutions that health and sanitary measures were basic to mobilization activities. The program has transcended the war period, however, because its functions are equally vital in time of peace, and health

and sanitation work is now being carried out in 14 Latin-American countries by the governments of those countries and of the United States.

Under the aegis of this program, hospitals, health centers, water supply and sewerage systems, and other health and sanitary facilities have been constructed. Numerous projects have been undertaken in preventive medicine against major disease problems.

In the industrial hygiene field, however, the only activity up to 1947 was found in Bolivia. This program was precipitated by a series of studies undertaken by the United States at the request of the Bolivian Government. A discussion of the program will be found in the following section.

Bolivia

The deleterious effect of poor health on production in Bolivia was brought out forcefully during the early part of World War II. As Bolivia was—and still is—the only source of tin available to the United States and the Allies, we were vitally concerned with her production schedules. It was soon realized that these schedules were seriously hampered by the poor health of Bolivian workers and the unsafe and insanitary conditions under which they worked and lived.

The exigency of war, however, placed prime stress on financial and technical considerations in the production of strategic materials. Attention to the health factor was relegated to a later time, when the Bolivian Government requested the United States to undertake a series of studies with regard to health, sanitation, and other aspects of Bolivian mining. These studies resulted in the inauguration on October 1, 1945, of a joint labor program, scheduled to operate for 2 years. The program was integrated into the regular public health program operated jointly by the Bolivian Government and the Division of Health and Sanitation of the Institute of Inter-American Affairs. This cooperative health service is known as the Servicio Cooperativo Inter-Americano de Salud Publica, or SCISP. The agreement with regard to the labor program had as its objectives (1) the development of industrial hygiene and safety in Bolivian industry; (2) the establishment of an employment service; (3) the establishment of a labor statistics system; (4) the development of a labor inspection service; and (5) the organization of an actuarial service. These were the same objectives as those defined by the joint Bolivian-United States Labor Commission (Magruder Commission), which had made the determining studies. The only recommendation omitted was that a study of living conditions in the mine regions be made. This responsibility was separately assigned to a field party operating under the regular health and sanitation program.

In accordance with the plans for carrying out this labor program, the Institute of Inter-American Affairs had employed several special-

ists. These included a labor economist, an industrial hygiene engineer, a safety engineer, and a labor statistician. In the brief period of a year and a half, this small nucleus of specialists, with the help of Bolivian technicians whom they trained, has made an excellent start in the development of a program to improve the health and safety of Bolivian workers.

Among some of the accomplishments of this small group, the following may be listed: (1) The recruitment and training of personnel. Several Bolivians were trained in the United States in industrial hygiene and safety and allied fields. These were a physician, an industrial hygiene engineer, a safety engineer, a labor inspector, and a labor statistician. (2) Various mines and factories have been surveyed by the Institute of Inter-American Affairs' field party. The total population in those industries which have been visited to date is slightly more than 30,000. As a result of some of these surveys, some recommendations for the improvement of health and safety conditions have already been made. (3) An industrial hygiene dust laboratory has been established and personnel has been trained in the technique of sampling and determining dust. Some of these trainees have been employed by mining establishments. (4) Various factory inspection forms have been developed. (5) Manuals on industrial hygiene and safety have been developed, printed, and distributed widely. (6) Seminars have been held for physicians and engineers on health and safety problems. (7) Bolivia's labor laws have been reviewed and abstracted for the use of labor inspectors. (8) An employment service manual has been prepared. (9) A dictionary of occupational titles for occupations common in Bolivia is in process of preparation. (10) A labor statistical service is being organized within the Ministry of Labor.

As the labor program approached its final stages, those responsible for it deemed it advisable to have an outside person review its progress and accomplishments in the field of industrial hygiene and suggest steps which might be taken toward the organization of a permanent program to be carried on by the Bolivian Government itself at the close of the present cooperative program. At the request of the Institute of Inter-American Affairs, the author of this report was assigned by the United States Public Health Service as an industrial hygiene consultant to the labor program. The Bolivian report is based on observations made by the author during the period of February 3 to April 16, 1947.

Peru

Abundant deposits of oil, coal, iron, and other metals insure broad economic horizons for Peru. A rapidly expanding manufacturing industry likewise augurs well for the country's prosperity. The increasing emphasis on manufacture, however, has trained the floodlight of inspection on the welfare of the country's workers. In this changing

economic order it has become more and more apparent that the full utilization of Peru's capacities is impeded by the low standards of living of her people.

Realizing her problem, Peru, during the last decade, enacted progressive social legislation to improve the lot of the worker. Unfortunately, much of the legislation, though well conceived, has suffered from lack of adequate implementation. Compulsory sickness insurance, old age and death benefits, and workmen's compensation for accidents and occupational diseases have been provided by law for some time, but Congress did not enact any legislation for the prevention of industrial disease until March 12, 1947. On that date, the Department of Industrial Hygiene was created by law in the Ministry of Public Health and Social Welfare.

The enabling legislation authorized the Department to: (1) Carry on a medical and engineering control program in industry in order to minimize and eliminate occupational diseases; (2) conduct research; (3) carry on educational campaigns; and (4) promulgate rules and regulations for the control and prevention of industrial health hazards. (A copy of the law will be found in the appendix.)

During the first 2 years of its operation, the work of the Department must be confined to six political departments: Lima, Ica, Junin, Pasco, Huanuco, and Huancavelica. Later, if the need is indicated, the Department may extend its functions to the entire country.

Financial support for the Department of Industrial Hygiene comes from a levy of 1.8 percent on pay rolls of companies employing more than 30 workers. For the present, contributions come from companies "which perform work or make use of mineral substances and soils, rocks, clays, sands, gravels, cements, as well as industrial processes related to the preparation and use of the above substances."

Soon after the law was enacted, the Minister of Health and Social Welfare invited the author to come to Peru to assist him in studying the industrial hygiene problems of the country and in organizing the new Department of Industrial Hygiene. On June 16, 1947, under the auspices of the Division of Health and Sanitation of the Institute of Inter-American Affairs, the author arrived in Lima where he worked jointly with the Ministry of Health and Social Welfare, and the Servicio Cooperativo Inter-Americano de Salud Publica. The Peruvian report is based on observations made by the author during the period June 17 to August 29, 1947.

Chile

Chile enjoys world prominence in natural deposits of sodium nitrate and ranks second in copper production. The war, however, has caused Chile to look to new manufacturing vistas. This development of manufacturing enterprises was necessitated both to satisfy home consumption needs and to take up the slack in the nitrate market which was

caused by the production of synthetic nitrates. Chile has also launched steel production to help build a more widely industrialized economy, and at the same time she is directing parallel efforts at building up the health of her workers.

An invitation was extended to the author early in September 1947 by the Ministry of Health to study industrial hygiene problems in Chile and to devise methods of strengthening existing industrial hygiene services. The desired study was conducted under the auspices of the Division of Health and Sanitation of the Institute of Inter-American Affairs from September 22 to November 10, 1947.

CONTENT OF REPORTS

The reports of Bolivia, Peru, and Chile contain information on potential health hazards in industry and on methods currently employed to deal with such hazards and set forth recommendations for the improvement of industrial hygiene practices. They discuss existing legislation bearing on industrial hygiene, the functions of agencies concerned with the practice of industrial hygiene, and recommendations for the strengthening and coordination of such services. For the sake of brevity, other pertinent information essential to the administration of an industrial hygiene program is omitted from these reports. Such information has been presented separately to those responsible for industrial hygiene in the three countries under study. It includes rules and regulations for the control of occupational diseases; a manual of good practice, which in essence is an interpretation of the rules; a set of qualifications for industrial hygiene personnel; and, finally, a list of field and laboratory equipment necessary for the conduct of industrial hygiene.

In short, an attempt has been made to define the industrial hygiene problems in Bolivia, Peru, and Chile and to present a definite program for their solution.

II. Method of Study

Several methods may be employed in defining the industrial health problems of a locality. The nature and prevalence of industrial health hazards may be established either by detailed studies of workers' health and job environments, or by an analysis of occupational morbidity and mortality statistics. In order to define the problem by the first method, it is necessary to make extensive studies of the health of the workers and the working environments in various industries. This is an undertaking of no small magnitude, requiring the services of a staff of specialists in the various phases of industrial hygiene. The second method is possible only if accurate statistics on occupational morbidity and mortality are available. Since conditions in Bolivia and Peru precluded the use of either method and insufficient data were available in Chile, it was decided to determine the nature and extent of industrial hygiene problems by finding out the number and types of industries in each country, the number of persons employed in them, and the health hazards to which these workers are exposed.

Accordingly, a survey of a small number of representative mines and manufacturing establishments was conducted, during which special survey forms were used to record observations. In brief, the survey attempted to obtain information on operations and health hazards in the representative working establishments chosen and the control methods in use. Information was also obtained on other existing facilities for coping with these health hazards, such as medical services, safety and hygiene services, plant sanitation, and feeding facilities. Data were also obtained on labor turnover, housing conditions, schools, markets, recreation facilities, and community sanitation. Available records on occupational diseases were also obtained. (See appendix I for forms used.)

In Peru it was apparent that those responsible for the enactment of the present industrial hygiene law had long been aware of the serious health hazards which exist in industry. However, there was no one source of information which presented a well-rounded picture of these hazards. Scattered information obtained from individual studies of silicosis, lead poisoning, industrial physiology at high altitudes, and other investigations indicated an extremely high incidence of occupa-

tional diseases among workers—especially among mine workers. Therefore, before the over-all problem could be defined and a solution devised, it was necessary to obtain first-hand information.

In Chile there has been industrial hygiene activity for some 15 years. The Industrial Hygiene Division of the National Department of Health has made some surveys of potential health problems in a few of the nation's industrial centers. These, of course, were available to the author. Finally, toward the close of the study, two conferences were held with key representatives of industry and government. The major findings of the survey were discussed and a specific program of industrial hygiene for Chile presented for consideration. These conferences were sponsored jointly by the Manufacturing Society of Chile and the School of Public Health.

In Bolivia the regions where the study was made were the manufacturing areas around La Paz and Cochabamba and the tin mines around Oruro and Potosi.

In Peru the survey was made primarily in four regions of the country: the mining region of the central Andes; the mining region of southern Peru; the mining and petroleum area in the North; and the industrial area in Lima and its environs.

In Chile the survey was conducted in three regions of the country: the industrial section around Santiago; the coal mining and manufacturing region adjoining Concepcion; and the northern region around Antofagasta. Throughout the studies, the author received the wholehearted cooperation of industry and government, both of which placed all of their facilities and records at his disposal.

III. General Information

Vicissitudes of living call for the dissociation of man into a number of functional units. For a certain number of hours a day, he is known as a worker. The rest of the time he is a citizen—taking an interest in his family and community affairs, seeking relaxation, undertaking other types of activity. In stepping from one role to another, however, man does not undergo a change. He remains the same, subject to all the limitations and susceptibilities that are the lot of human beings. Clearly then, the health of workers cannot be considered in terms of the working environment alone. All factors that influence them as total personalities must be brought to bear in seeking to obtain a complete, meaningful picture. Full consideration must be given all these stimuli in the formulation of a sound, effective industrial hygiene program. For that reason, attention was also paid in this report to the economic resources of the countries studied, socioeconomic conditions, educational opportunities, and other related factors. An attempt was made to touch upon all the elements that enter into a complete evaluation of industrial hygiene problems.

ECONOMIC RESOURCES

Bolivia

Although Bolivia has remarkable economic possibilities in agriculture, petroleum, and other raw materials, mining has been its principal industry for many centuries. The economy of the country is closely linked to mining, to tin mining in particular. Tin is Bolivia's largest export and its most important source of revenue.

Peru

Peru's natural resources are many and its opportunities for economic betterment are great. Although Peru is primarily an agricultural nation, its manufacturing industry is growing rapidly, and it is extremely rich in mineral resources. Until recently, Peru's topography has retarded the development of some of these resources. But in the

past few years a number of good roads have been constructed which connect the three important sections of the country and make good transportation and communication services possible on a national scale.

Aviation is also playing an increasingly large role in the communication field.

Peru has been a storehouse of minerals ever since colonial days and is still an important source of oil and metals. Its coal mines, which have recently been developed, will satisfy at least its domestic needs for a long time. Iron deposits which are now being opened will make it possible for Peru to have steel, especially when the hydro-electric projects are completed in the Chimbote area.

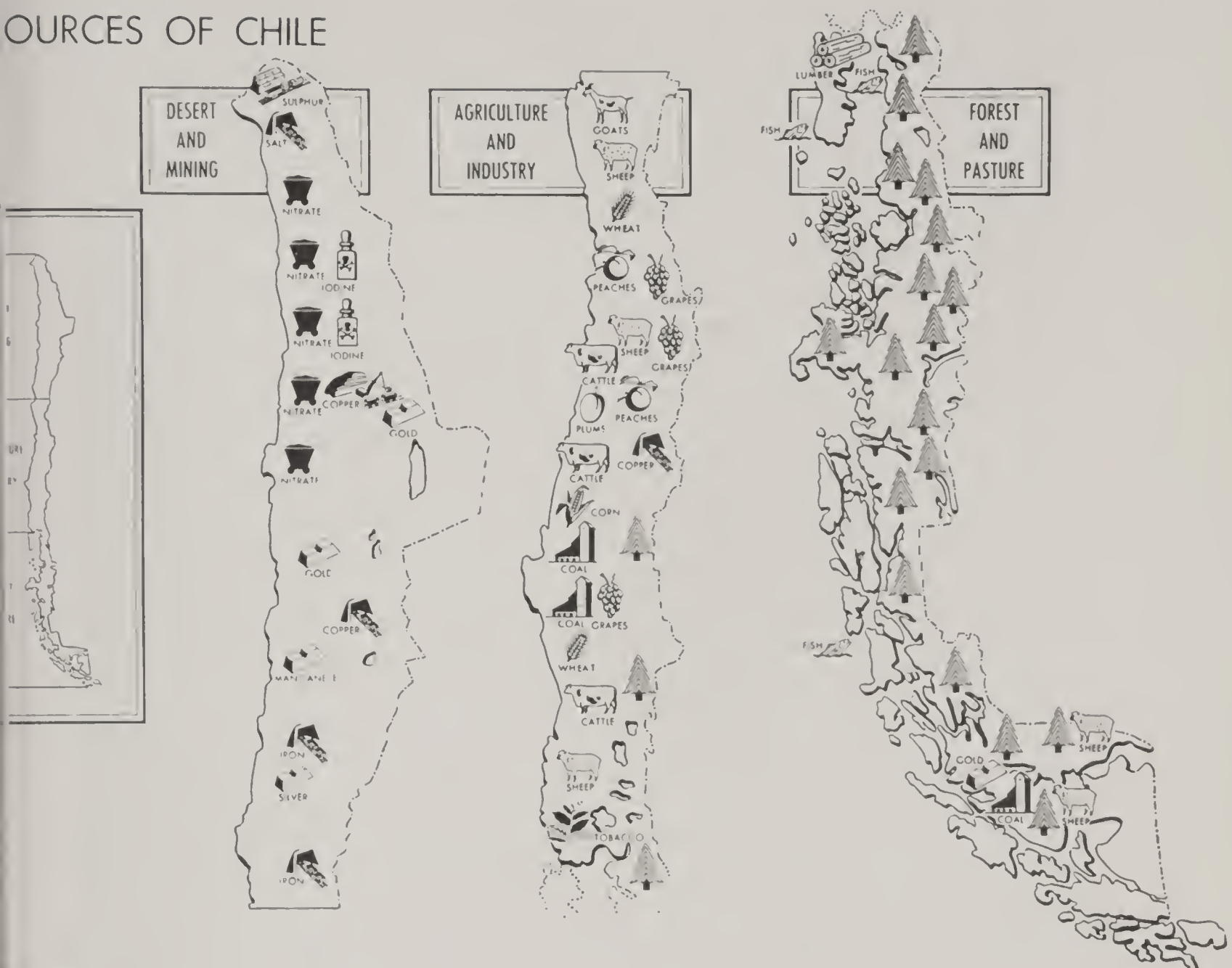
Chile

Chile's mineral resources, especially its copper and nitrates, figure prominently in its international trade. Chile is the second copper producing nation in the world and is the only country which has

sodium nitrate deposits of great commercial value. Prior to the war, minerals made up nearly 80 percent of the total value of the country's exports. However, the slump in the nitrate market caused by the production of synthetic nitrates and the war-induced need for producing manufactured goods for home consumption have forced Chile to develop manufacturing industries.

RESOURCES
OF PERU

PICTOGRAPH CORPORATION



With regard to natural resources, Chile may be roughly divided into three zones: the northern desert zone which contains important copper, nitrate, and iodine deposits, and other mineral mines; the central zone which includes the country's largest cities and is an agricultural and industrial area; and the southern zone which is the forest and pasture land of the country.

In the southern zone are also located coal mines, which are the largest in Latin America, and iron-ore deposits, which are being exploited increasingly every year. These coal mines and iron-ore deposits make the area a natural center for the production of steel. At the present time a steel mill is under construction just outside of Concepcion. The production of steel should assist the country materially in developing manufacturing industries.

POPULATION

Bolivia, with an area approximately the size of the States of Texas and California, has an estimated population of 3,750,000. Of this number, about 500,000 are city dwellers and another 500,000 occupy

the unexplored lowlands. The remainder of the population lives in rural areas of the altiplano and is predominantly Indian in race. According to the latest data on Bolivia, about 13 percent of the population is white and principally of Spanish descent, about 27 percent is of mixed Spanish and Indian blood, about 53 percent is Indian, and the remaining seven percent is unclassified and includes a small number of Negroes.

Peru is the third largest country on the South America continent and is approximately the size of Texas, New Mexico, and Arizona combined. It has an estimated population of 7,853,953. Nearly three-fourths of this population lives in the Sierra region, which comprises about one-third of the total area of the country. The racial distribution of the population is about 57 percent, Indian; 25 percent, Mestizo; 14 percent, white; two percent, Negro; and two percent, Asiatic, chiefly Japanese. When it comes to language spoken, however, the picture is somewhat different. Forty-seven percent speak Spanish only; 35 per cent, one of the Indian tongues (Quechua or Aymara); and the rest speak a mixture of Spanish and other languages.

Chile is slightly smaller than the West Coast States of California, Oregon, and Washington combined. In 1946, the estimated population of Chile was 5,702,000. More than half the population is concentrated in the central region, and about a fourth lives in the Santiago province. The people are distributed almost equally between urban and rural areas of the country.

Chile is predominantly European in its racial make-up; its people trace their ancestry back to practically every country on the continent. Fewer than one percent of the population are full-blooded Indians.

INCOME

Living standards are in direct ratio to the purchasing power of any locality. The meager purchasing power generated by low wage scales makes for low standards of living in Bolivia, Peru, and Chile.

The average wages of a factory worker in Bolivia range from 14 to 20 Bolivianos a day. A miner makes approximately 38 Bolivianos a day.[1]

The wages of a mine worker in Peru range from a minimum of 4 to a maximum of 10 soles per day and average about 6.50 soles a day. In most factories wages are somewhat higher, starting with a minimum of 2.50 soles for beginners and going as high as 14 soles a day in some of the large factories in Lima. Average pay is about 8 soles per day.

In the Chilean factories visited during this study, average wages ranged from a minimum of 20 and 28 pesos a day for women and men, respectively, to a maximum of 95 pesos a day, the average being somewhere around 75 pesos. However, the factories visited by the author

[1] Currency equivalents as of May 1948: $1, 42.0 Bolivanos; $1, 6.5 soles; $1, 31.1 pesos.

were located in urban centers where wages are known to be higher than elsewhere in the country. According to statistics of the Workers' Compulsory Insurance Fund, which has fairly accurate data on this subject, the average wage of a factory worker in Chile is 30 pesos a day. The wages of miners range from 50 to 90 pesos a day.

On the whole, miners in the three countries are better off than factory workers, in that they have employer-provided "benefits." Free or low-cost housing, free medical care and hospitalization for mine workers and their families, and primary schools for their children are provided by the larger companies. Miners also have the opportunity to buy from company stores, or pulperias, which sell goods at cost or at a slight loss.

In one large company store in Peru, for example, the prices of some eight essential food items were at least 20 percent lower than in other stores in the community. This practice creates a problem since employees resell goods they buy to obtain extra funds. When company stores run out of goods, private stores raise prices for goods in short supply. Table 1 shows prices charged by private stores and a company store in one mining area in Peru.

Table 1.—*Comparison of prices between a company managed store and private stores in Peru*

Item	Prices in soles	
	Company managed	Private
Spaghetti per kilo	1.00	1.80
Pork per kilo	5.20	8.00
Shoes per pair	27.80	39.00
Sugar per kilo	0.32	0.40
Cloth materials per metre	1.60	3.50
Meat per kilo	1.00	2.20
Oats per kilo	1.60	2.20
Bread:		
Per 84 grms.	0.05	
Per 40 grms.		0.05

Most companies claim that they lose a day's pay on every worker in the pulperia. On the other hand, rather than raise wages so that the miner may purchase his goods wherever he wishes, the mining companies prefer the pulperia system for many reasons, even though the pulperia has been outlawed in some countries. Perhaps one of the most important reasons for not abandoning the pulperia lies in the fact that workmen's compensation and other social security benefits are based on the miner's actual wages, and do not take into consideration wages in kind, such as accrue to the worker from the cheap pulperia and other employer-provided "benefits."

Despite the cheap food, housing facilities, free primary schools, and

recreational facilities furnished by the larger companies, the prevailing low wages in Bolivia, Peru, and Chile do not provide sufficient funds for a decent standard of living.

The rampant inflation which these countries have experienced has made the lot of the wage earner even more difficult. Many of the bare necessities of life, such as clothing, are so expensive that they constitute a luxury to the average mine and factory worker. The same is true of many basic food supplies.

The food problem is further complicated in Bolivia because that country is largely dependent on foreign, and sometimes distant, production. There have been shortages recently of sugar, wheat, meat, rice, flour, and other staples, especially in the mining centers and in some of the large cities of the altiplano. Frequently, crop failure in other countries and breakdowns in Bolivia's poor transportation system halt the steady flow of food into the country.

Chilean studies, too, bear out the disproportionately high cost of food. It is estimated that the amount of income spent for this necessity ranges anywhere from 33 to 75 percent. As a result of the high cost of foodstuffs, 50 percent of the workers and their families suffer from malnutrition. In fact, recent investigations in the coal mining areas of Chile indicate that coal miners have a daily diet deficiency of 1,600 calories. This lack must certainly play an important role in the high incidence of many communicable diseases among this group of workers.

HOUSING AND LIVING CONDITIONS

Housing in Bolivia, Peru, and Chile is in acutely short supply. Even in Chile, where management-furnished housing is an improvement over that of some of the other South American countries, most dwellings, especially in the mining communities, are drab, overcrowded, and insanitary. They frequently lack even the most elementary sanitary facilities. Such conditions are also true of some of the large cities in these countries. Information obtained from a survey of establishments in Peru typifies the prevailing situation in all three countries under study. Detailed data on community facilities available to these workers are presented in table 2.

Many of the miners' homes are of the adobe type or built out of cinder blocks. Usually, houses are constructed in a series of 20 or more to a unit or block. The houses vary from one room to as many as three and sometimes four rooms. The latter, however, are usually reserved for white collar workers, or empleados, and a nominal charge is made for them. At one large establishment in Peru two-room houses rented for 3.75 soles a month; three-room houses, for 7.50; and the four-room variety, for 12.50.

Plant No.	Type of industry	Number of workers	Housing conditions						Schools	Community stores		Remarks
			General	Sanitary facilities				Garbage collection		Operated by	Type	
				Water	Sewage	Toilets	Communal[1] facilities					
1	Metal mine	250	Very poor; adobe huts; crowded	Spigots outside	Open ditch	Latrine	yes		Company, 2 grades	Company	Mercantile: meat; vegetables	
2	Metal mine and mill	3,000	Poor; crowded	do	Private system	Privy	yes		Company, 3 grades, 2 rooms	do	General	New houses being built.
3	Copper mine and mill	650	Crowded	do	Open ditch	Latrine	yes	Daily	Company, 5 grades	do	Mercantile	
4	Metal mine and mill	707	Fair	do	None	Privy over river	yes		Company, 4 grades (clean)	do	do	
5	do	626	Poor; crowded	do	Open ditch	Latrine	yes		Company built; government operated	do	Mercantile; meat	
6	do	1,487	Very bad; crowded	do	do	do	yes		Company, 4 grades	do	General, meat, vegetables	
7	do	500	Adobe; old; crowded	do	do	None	yes		Company, 6 grades	do	Mercantile	
8	Vanadium mill	750	Poor; crowded	do	do	Privy	yes		Company, 4 grades, 2 rooms	do	General	All facilities inadequate. Isolated camp. New houses and school being built.
9	Gold mine and mill	450	Bad; very crowded	do	None	Latrine			Company, 6 grades, (fair)	Private[2]	Mercantile	Bad and insanitary camp. Malaria sources.
10	Metal smelter	3,150	Poor; crowded	do	Open	None	yes		Company, grade	Company	Mercantile, meat, vegetables	
11	Coal mine	1,900	Good; clean	do	do	Straddle	yes[3]		Company, 5 grades	do	Mercantile	New homes and recreation facilities being built.
12	Coal mine and washer	500	Poor; crowded; filthy	do	None	Latrine	yes		Company, 3 grades	Private[2]	do	Dusty and insanitary camp. Inhabitants' faces black.
13	Coal washer	150	Poor; adobe; crowded	do	Open stream	None	yes		Company, grade	Company	General	
14	Oil and gasoline production	5,000	Poor; crowded; filthy	do	Private system	Latrine	yes	yes	Company, 6 grades (good	Company and private	All types	Building new town. Old site insanitary and poorly maintained.
15	Dam and tunnel construction	1,060	Good	do	do	Privy	yes	yes	Company, 5 grades	Company	General	
16	R.R. and power plant construction	350			Workers live in town							
17	Wool cloth mill	984			do				Town, Company pays tuition	Company	Mercantile	
18	Cement production	809	Fair; crowded	Spigots outside	Septic tank	Flush	yes		Company, grade	do	General	Will provide better housing.
19	Asbestos building material	180			Workers live in town							Plant has auditorium, library, classes in hygiene.
20	Refractory bricks, chinaware	262			do							
21	Glass bottles	170			do							

[1] Refers to common areas for baths, toilets, and laundry facilities.
[2] Company controls prices.
[3] Clean.

Nearly three out of four houses in many of the camps are of the one-room variety. As a consequence, crowding is a critical problem. It is not uncommon to find four to eight persons living in one room, which also serves as a kitchen, dining room, and bedroom. For example, in one community where 2,600 workers are employed, there are 1,650 houses. In another large mining camp employing nearly 3,000 only 450 houses are available.

Similar conditions were observed in Chile. Houses around the sulfate mines in the northern desert and the coal mines around Concepcion were too few in number and lacking in sanitation besides. Dwellings around the larger copper mines were fair on the whole, although there were not enough of them. Homes at a sugar refinery and in the nitrate fields in the north were perhaps the best found in this survey. The photographs which follow clearly show the difference between the houses provided.

In the coal mining area of Chile some 4,000 houses were surveyed. Nearly 1,500 were insanitary and 1,600 uninhabitable. Single persons, as a rule, shared one-room houses, which were occupied by as many as four adults. In one large copper mining concern there were approximately 1,700 houses for 8,000 persons. The average number of persons per room was 3.7, and the average number of persons per bedroom, 5.1. The average number of persons per bed was 2.2. Housing conditions in these mines were by no means the worst in Chile; dwellings provided for workers in the fishing industry were not even as good.

A worker's dwelling and his family at a coal mining camp

Worker's model house at a sugar refinery

As a rule, water is obtained from spigots at each end of a block of houses. Toilets, as well as laundry and shower facilities, are usually of the communal type. Waste water runs into uncovered troughs in outside ditches which are also used for garbage and sewage. As far as can be determined, none of the water supplies is approved.

With the exception of two or three large mining concerns in Chile, human waste was permitted to flow untreated into nearby streams or into the open desert. In only a few instances are facilities available for garbage removal. Carrion and fly-infested garbage litter the backs of houses and the streets.

There is no denying that, by comparison with some of the privately owned huts of some of the workers, most company houses are a great improvement. In many, but not all, of the larger mining communities, animals are not allowed around the houses in the camps. In all the privately owned homes, domestic animals have free access to the workers' homes. At present, few miners own their own homes. It is understood that most of them would like to own their own homes, so that they can have gardens, keep their animals, and gain a sense of stability, which they do not have now.

The problem of labor turnover is influenced to some extent by this lack of stability. It is felt that industrial establishments should encourage workers to have their own homes and assist as much as possible toward the achievement of this objective. The excuse which many

firms now give for failing to encourage home ownership is that the workers would abuse it. This is not a valid excuse, since a company's responsibility, as well as that of the Government itself, should not end with the provision of the means and the opportunity for owning a home. It should go beyond that and include an educational program to teach the workers how to live in a sanitary and healthful fashion.

Most of the larger concerns are fully aware of the housing problem and are attempting to build additional housing. Unfortunately, with the single exception of one large petroleum company in Peru which has an ambitious modern housing program, the companies are making the same mistakes in their new housing projects that they did in their old ones. Many of the townsites are selected with no regard for health and sanitation requirements, and the houses still lack elementary sanitary facilities. The workers' houses being built by the petroleum company are an exception to the rule. They are models in construction and sanitation and should be conducive to good health and well-being.

In 1936, Chile established the Popular Housing Fund for the construction of low-cost houses. The Fund has improved the situation somewhat, but its program has been inadequate for the needs of the country. It is estimated that about 300,000 homes are needed to alleviate the present congestion. At the current rate of construction, 10 years will elapse before that many houses can be built.

In summary, therefore, it may be said that housing and living conditions in industrial communities in these three countries, especially

Workers' houses at a smelter

in the mining areas, are inadequate in quality and insufficient in quantity. A vigorous housing program on the part of the Government and the industries concerned is needed. Concurrently with such a program, workers and their families should get the benefit of a vigorous educational program on healthful living. With perhaps one or two exceptions, neither the Government nor industry has conducted such campaigns. Living conditions as they exist now are potential sources of ill health and no doubt are factors contributing to the social unrest and labor strife prevalent in Bolivia, Peru, and Chile.

EDUCATION

Closely related to poor health, poor housing, and low wages, are such social problems as illiteracy. It has been estimated that in Bolivia 80 percent of the population is illiterate and that not over one-sixth of the school age children are enrolled in schools.

Many children under 14 years of age are employed in mines and factories Child labor not only deprives these youngsters of the educational opportunities they should have, but definitely imperils their health and future productiveness.

Perhaps the greatest educational problem in Peru is the incorporation of the Indian into the nation's life and society. Native Indian languages are spoken by a great majority of the people. Indian culture and tradition affect every aspect of Peruvian life, including industry.

According to the 1940 census, only 42 percent of the population was literate. The rate of literacy varied from approximately 93 percent in Callao to only 12.6 percent in Apurimac. In the Sierra, where most of the mining communities are located, the percentage of literacy was lowest, because of the large Indian population there and the lack of adequate educational facilities. According to law, mining companies in whose communities more than 30 children live are required to maintain schools. The company is required to build and maintain the school building and pay the salaries of the teachers who are appointed by the Government. The equivalent of at least the first four grades must be taught in these schools. Special literacy schools are also supposed to be provided for adults whenever 20 persons make known their wish to study.

Most of the schools visited in both Bolivia and Peru were overcrowded and lacked the most elementary materials and equipment. A few of these schools did not go beyond the second grade of instruction. Various studies reveal that primary education, such as it is, is available to only a small fraction of the population. As already mentioned, many schools lack rudimentary facilities such as chairs, desks, books, blackboards, and chalk. Many of those visited lack proper sanitary

facilities and, with but one or two exceptions, fresh air is shunned in most of the schools—the windows are hermetically sealed. Obviously, the lack of ventilation and the unhygienic state of the pupils are not conducive to either good health or comfort. Furthermore, the extremely low salaries paid to teachers do not attract qualified persons to the profession.

Hygiene is generally unknown to the Indians, so that health education is a major and urgent necessity. In Bolivia no effort was made to teach it in the schools before the initiation of the cooperative programs of the Inter-American Educational Foundation and the Institute of Inter-American Affairs. However, it is impossible to bring such education to large groups of people who cannot read and who do not even speak the same language as the teachers.

In comparison with other South American nations, Chile is making great progress in the field of public education. More than 70 percent of its people are literate and the number of persons receiving higher education is steadily increasing. Table 3 shows the extent of school attendance in Chile as revealed by the 1940 census. It may be seen from this table that nearly 60 percent of the population 7 years of age or older receive primary instruction. This is all the education that the vast majority of the population receives, for only about ten percent

Table 3.—*Educational status of persons 7 years old and over, in Chile*

Degree of instruction	Number			Percent		
	Total	Male	Female	Total	Male	Female
Primary	2,376,065	1,190,160	1,185,905	58.8	59.7	58.0
Secondary	390,884	191,788	199,096	9.7	9.6	9.7
University	50,087	35,042	15,045	1.2	1.8	0.7
Technical	44,223	25,604	18,619	1.1	1.3	0.9
Cannot read	1,177,699	549,652	628,047	29.2	27.6	30.7
Total	4,038,958	1,992,246	2,046,712	100.0	100.0	100.0
No data available	113,231	56,384	56,847	----------	----------	----------

go on to high school. About one percent receives university training; and another one percent, training of a technical character. Many other countries in South America send students to universities in Chile. Most of the Chilean schools visited during the survey were fairly adequate and were maintained in a sanitary condition.

In general, the lack of adequate school facilities and instruction all operate against building a strong and healthy race. Education plays an important role in determining the health and productivity of the working population.

COMMUNITY HEALTH AND SANITATION

Bolivia

According to studies made by personnel of the Institute of Inter-American Affairs and studies of medical and sanitary conditions made by the United States Army, general health conditions in Bolivia are very unsatisfactory.

Malaria, tuberculosis, venereal diseases, leprosy, epidemic typhus, intestinal parasites, smallpox, typhoid fever, yellow fever, and bubonic plague are common throughout Bolivia. Malaria is prevalent in over 80 percent of the country. Epidemic louse-borne typhus is common throughout the highlands. Official reports state that 98 to 100 percent of the population has helminthiasis. Infant mortality is known to be much higher than the reported 110 per 1,000 live births. Disease control is made especially difficult by the diversity of races, the heterogeneity of customs, lack of transportation and means of communication, and low standards of living.

The development of Bolivia's rich natural resources is largely inhibited by disease, control of which is in turn limited by lack of funds and trained personnel. In 1944, Bolivia appropriated about $1,041,742 (U.S.) for public health, less than 30 cents per capita for the estimated population of about 3,750,000. By comparison, the United States budgets more than $2 per capita for State health work.

In 1945, there were 72 hospitals in Bolivia, with a total of 4,229 beds, the ratio of beds per 1,000 inhabitants ranging from 0.6 in the Department of Santa Cruz to 2.7 in the Department of Beni. In 1946, there were 569 physicians in the entire country (one for every 6,000 persons), nearly half of whom were concentrated in La Paz. Well-trained nurses and technicians are also scarce, so that thousands of Bolivians are not able to secure even the simplest medical attention. According to a survey made by the United States Army Medical Corps it was found that over 60 percent of the people in Bolivia do not have medical attention during their final illness.

There is not a single safe water system under proper control in the entire country and there are, as a result, recurrent outbreaks of typhoid fever all over the country. Several of the larger towns have sewers, but there are no sewage treatment facilities.

Peru

As in Bolivia, lack of funds and trained personnel militates against the control of disease in Peru. The rural areas especially suffer from the scarcity of doctors, nurses and hospitals. Most of the trained professional workers and facilities are located in Lima. In 1947, Peru appropriated approximately $4,800,000 (U.S.) for public health, or about 60 cents per capita.

There are only about two safe water systems in the entire country, and it is only within the last year that the Ministry of Public Health and Social Welfare has been given responsibility for the administration of water supply. This function will be carried out by the Department of Sanitary Engineering, which, at the moment, has only seven trained sanitary engineers.

Sewage treatment is practically unheard of in Peru. Several of the large cities have sewers, but no treatment facilities. Incidence of tuberculosis is known to be high in Peru and is one of the major communicable disease problems of the country. Although rates are not available for most of the communicable diseases, some idea of the health problems of the country may be gleaned from the experience of 1946. In that year, 123,490 cases of infectious diseases were reported to the Ministry of Health. Of these, 57,883 were malaria; 18,671, tuberculosis; 12,295, whooping cough; and 6,931, dysentery. Mortality from tuberculosis averages about ten times as high as in the United States. It is well known that the reporting of communicable diseases in Peru is inadequate, and undoubtedly these data are an underestimate.

Proportional mortality is available for 1945. These data show that of all deaths reported, tuberculosis accounted for 6.2 percent; pneumonia, 1.4 percent; grippe, 8.1 percent; and other respiratory diseases, 12.9 percent. In other words, respiratory diseases accounted for 28.6 percent of all deaths in Peru during 1945.

The administration of public health in Peru is largely a centralized function of the Ministry of Health and Social Welfare. With the exception of the work going on in cooperation with the Institute of Inter-American Affairs in a few restricted areas, departmental, provincial, or local public health work is an unheard of phenomenon in Peru. Although mining companies are obliged by law to provide camps, schools, and sanitation services, such as water and sewage disposal, there has not been adequate governmental supervision and administration of community sanitation. Leadership has been lacking, too, in assisting industry to improve public health conditions in industrial areas.

Chile

Many agencies concern themselves with health and welfare in Chile. The majority of these, however, are interested in curative medicine. Preventive medical care is left largely in the hands of the Department of Health.

The administration of public health in Chile, as in most Latin American countries, is centralized under the Director General of Health whose headquarters are in Santiago. Branch offices are located in the various provinces, which for administrative purposes are grouped together into zones. With the exception of one or two provinces, public health work is in the hands of part-time professional personnel, most of whom have not had formal public health training. This deficiency

is slowly being overcome through training programs for public health workers given by the recently organized School of Public Health. Chile is slowly building up a nucleus of trained public health workers, but many years will elapse before a sufficient number are trained.

Another drawback to the expansion of public health programs has been lack of funds. At the present time, the budget for public health in Chile is approximately 25 pesos, or roughly, 75 cents (U.S.) per capita per year at the official rate of exchange.

It is well known that there is a scarcity of physicians, nurses, and hospitals in Chile. There are approximately 2,000 physicians, or roughly one for every 2,500 persons. This distribution is better than in some South American countries, but it is not good. The shortage of professional health personnel is more acute in rural areas since physicians and nurses tend to congregate in the larger urban centers where remuneration is greater.

The general mortality rate in Chile is roughly double that of the United States. Although infant mortality is decreasing, it is still high, the average rate registered for the period 1941-45 being 170. The control of communicable diseases, especially tuberculosis, is still a major and serious problem. Typhoid is quite prevalent. Hookworm is epidemic in some areas, notably in the coal mining section of the country. In some of the coal mines studied recently about 65 percent of the workers were found to be infested with the hookworm parasite.

Tuberculosis merits special discussion since it is probably Chile's outstanding health problem. Although the death rate from this disease recorded for 1946 is approximately 208 per hundred thousand, in many sections of the country the rate is much higher. In the city of Concepcion, the death rate in 1945 was slightly more than twice that registered for the country as a whole.

The tuberculosis problem is aggravated by the scarcity of hospital beds and by overcrowded housing, which make it impossible to isolate patients in their homes.

General community sanitation in Chile also leaves much to be desired. Only 25 percent of the people in all of Chile are served by water supply systems and an equal number are provided with sewerage facilities. With the exception of Santiago, only 85 percent of the urban population have approved drinking water while 65 percent have public sewerage facilities. There are 64 cities of more than 1,000 and less than 5,000 inhabitants which have no drinking water facilities and 155 cities which have no public sewerage. At present, through a cooperative program conducted by the Institute of Inter-American Affairs and the Ministry of Health, quite a lot is being done to improve the sanitary environment. This cooperative program is also improving the general health picture by constructing health centers in some districts. The work carried on in this joint program will be touched on later in this report.

This brief summary of public health problems in Chile indicates that progress is being made toward their solution. The problems are so large, however, that it will take many years of vigorous, sustained effort on the part of the Government, the people, industry, and labor itself, to raise the health level of the labor force. Unless this is done, however, Chile's plan to develop its resources and to raise its living standards will be seriously frustrated.

SUMMARY

The brief foregoing sketch of the background of the industrial populations of Bolivia, Peru, and Chile points up that niggardly wage scales, congested and unhygienic living conditions, and primitive sanitation predispose these countries to disease. Sickness rates—both general and occupational—are high. The pall of illiteracy in Bolivia and Peru further fosters these conditions and makes remedial education difficult. A comprehensive educational program in hygienic living should be attempted, however, despite these limitations. To improve facilities without accompanying sanitary instruction is to build on quicksand. Even the finest structure will soon crumble without proper maintenance. Against these socioeconomic needs, the added health problems which have their origin in the working environment must be studied and solved.

IV. Health in Industry

Since a worker's health is determined to a large degree by the response to both nonoccupational and occupational stimuli, a consideration of both sets of factors is necessary for a complete study. The socioeconomic conditions highlighted in the foregoing section reflect nonoccupational influences. Attention is now concentrated on the health problems that are directly related to the working environment.

In the course of these studies, health and safety problems inherent in industrial working environments were assessed in several ways. Although it was impossible to make detailed studies of the health of the workers or of working conditions, sufficient information was obtained about working environments and industrial health services provided in plants to get a good idea of occupational hazards and measures taken to correct them.

The present studies, although limited to a visual survey of the working environments in representative industries and a study of statistics available in the various government agencies concerned with industrial hygiene, do present a fairly comprehensive review of occupational hazards and the measures now in force to correct them.

GAINFULLY EMPLOYED

Bolivia

Although no accurate data are available on the size of the labor force in Bolivia, it is estimated from data furnished by the Caja de Seguro and the Chamber of Commerce that there are approximately 100,000 persons employed in the country's mines, factories, and service industries. Of this number, approximately 40,000 are employed in the mines.

Not even an estimate of the number of workers engaged in agricultural pursuits is available. It is known, however, that large numbers of agricultural workers, employed by owners of rubber and coffee plantations, live and work in isolated communities in the tropics.

Peru

The latest information on the size of the labor force in Peru is that based on the rather extensive 1940 census. At that time the number of

gainfully employed persons totaled 2,475,339, of which nearly 1,600,000 were males. It may be seen from table 4 that about 50 percent of the gainfully employed were found in agriculture. Manufacturing accounted for 380,000 persons and mining for nearly 45,000.

Due to the fact that most manufacturing industries produce light consumer goods for domestic use, a larger proportion of female workers is found in these establishments. Of the 380,000 persons in manufacturing, approximately 215,000 or 56 percent are women. The most important manufacturing industry in Peru is the textile industry. The manufacture of clothing and its accessories is second.

Table 4.—*Labor force by major industry group in Bolivia, Peru, and Chile*

Industry group	Number of persons		
	Total	Male	Female
BOLIVIA (data not available)			
Total labor force	(?)	(?)	(?)
Mining industries (estimated)	40,000	(?)	(?)
Manufacturing and service industries (estimated)	60,000	(?)	(?)
PERU (1940 census)			
Total labor force	2,475,339	1,598,321	877,018
Agriculture	1,293,214	931,468	361,746
Cattle raising, forestry, fishing, and hunting	252,975	129,008	123,967
Mining and similar industries	44,694	43,463	1,231
Manufacturing	380,281	165,516	214,765
Building, construction, and repair	45,659	44,782	877
Transportation and communication	51,079	48,656	2,423
Commerce, credit, and insurance	112,126	76,025	36,101
Public administration and other services of general interest	89,021	72,514	16,507
Individual professions, domestic and other personal services	165,099	53,879	111,220
Other economic fields not classified	41,191	33,010	8,181
CHILE (1940 census)			
Total labor force	1,621,300	1,325,939	295,361
Agriculture and fishing	620,489	580,723	39,766
Mining	91,220	89,479	1,741
Construction	64,559	63,640	919
Manufacturing	286,730	193,463	93,267
Trade	200,636	132,414	68,222
Transportation, communication, and public utilities	89,707	84,468	5,239
Finance and insurance	14,628	12,487	2,141
Domestic service	3,279	2,844	435
Government service	115,453	93,656	21,797
Miscellaneous industries	133,591	72,196	61,395
Unemployed	1,008	569	439

Of the nearly 45,000 persons employed in mines, the largest number, 7,000 are in the oil fields, with gold and copper mines coming next.

It may be seen from these data that more than a third of the population of Peru is gainfully employed. Of those employed, slightly more than a half million are engaged in industries, such as mining, milling, and manufacturing, with which major health hazards are usually associated.

Chile

Although no current estimate of the number of gainfully employed persons in Chile is available, 1940 census data are still accurate enough

to give an approximation of the total labor force. In 1940, out of a total population of approximately 5,000,000, nearly one-third were gainfully occupied. As may be seen from table 4, slightly more than 600,000, or 38 percent of the 1,700,000 gainfully employed persons, were engaged in agriculture. Manufacturing ranked second with approximately 290,000 workers; and mining accounted for slightly more than 90,000 persons. Only 300,000 women were in the labor force. Industrial workers in Chile constitute as large a group of employed persons as those engaged in agricultural pursuits, the two groups accounting for approximately 75 percent of the labor force. The balance of the working population includes professional and white-collar workers and a small number of people engaged in domestic service.

To summarize, one-third of the nation's population is employed, and of this number approximately 1,000,000 work in occupations with which health hazards are associated. From the standpoint of numbers alone, therefore, it is obvious that serious consideration should be directed to the health and safety problems of this group which makes up some 20 percent of the nation's human resources.

INDUSTRIES SURVEYED

A representative group of mining and manufacturing establishments in each of the three countries was surveyed to obtain first-hand information on health hazards and facilities for coping with them. The specific types of industries surveyed, together with number of establishments and workers included, are shown in table 5. In Bolivia, dust determinations made previously by the personnel of the labor section indicated silica dust exposures in the various establishments. Statistics on occupational diseases and some figures on accidents were obtained from individual concerns or government agencies. These helped to define the problem on a quantitative basis.

In general, the information gathered pertains to hazards in the working environment and their control; compensation and sickness benefits; medical services, including dentistry and nursing; safety precautions; disability records; feeding facilities; and general sanitation, such as water supply, sewage disposal, toilet facilities, and locker rooms.

Even though the number of workers and plants included in the survey appears to be small in relation to the total number of workers and establishments in each of the three countries, the plants selected were sufficiently representative of industry to allow the drawing of valid conclusions.

Bolivia

In Bolivia, 23 establishments were surveyed, employing a total of 26,488 workers, or approximately 25 percent of the estimated popula-

tion in manufacturing and mining industries. Fifteen of these were mines and mills, and eight were manufacturing or service industries. Thirteen of the mines produced tin, three of them producing some tungsten ore as well. All but 3 of the 13 tin mines also operated mills for concentrating ore. Of the two remaining mines, one produced antimony and the other copper. The latter also had a mill as part of its operations.

Table 5.—*Type of industries surveyed in Bolivia, Peru, and Chile*

Industry group	Bolivia		Peru		Chile	
	Establishments	Workers	Establishments	Workers	Establishments	Workers
All establishments surveyed	23	26,488	21	22,935	21	46,089
Mining industries	15	23,774	16	20,530	8	34,552
Mining, milling and/or smelting of:						
Antimony	1	28				
Coal			3	2,550	1	9,200
Copper	1	786	1	650	3	12,856
Gold			1	450		
Lead, copper, zinc, silver			7	9,720		
Nitrate					2	10,250
Sodium sulfate					1	746
Tin	13	22,960				
Vanadium			1	750		
Oil and gasoline production			1	5,000		
Hydroelectric construction; tunnel construction and mining			2	1,410		
Repair shops for copper company					1	1,500
Manufacturing industries	8	2,714	5	2,405	13	11,537
Canned fish					1	900
Sugar, industrial alcohol					1	606
Cotton, woolen textile mill products	1	1,000	1	984	2	2,815
Shoes; leather	3	315				
Glass products; chinaware; ceramics	1	750	2	432	4	3,201
Cement; asbestos building material	1	200	2	989		
Copper wire					1	840
Steel rods; metal products	1	145			2	1,750
Printing					1	140
Gas, coke, tar					1	1,285
Airplane service	1	304				

The 15 mining establishments employed a total of 23,774 workers, thereby accounting for the bulk of the persons included in this survey. This is not disproportionate, since mining and milling of ore is Bolivia's major industry and the most important one from the standpoint of economics and health hazards. Nine of the 15 mines and mills employed more than 500 workers, while the remainder employed fewer, two employing under 100 workers each.

The eight manufacturing and service establishments surveyed employed 2,714 workers. They included two shoe factories, a tannery, a large cotton textile plant, a glass bottle works, a cement mill (the only one in Bolivia), a foundry and machine shop, and an airplane repair shop.

Peru

The 21 mines and factories visited in Peru employed 22,935 workers. Of these 21 plants, five were manufacturing (a glass bottle works, a

cement mill, a refractory brick and chinaware plant, an asbestos and cement building material plant, and a woolen mill); 13 were mines, including a tunneling job for the hydroelectric project, a petroleum operation, a hydroelectric construction project, a smelter, and a coal washer. All the mines which produced metallic ores had concentrators. Of the 11 mines actually producing ore and concentrate, one was a gold mine; two produced coal; one, vanadium ore; and the balance, a mixture of copper, lead, zinc, and silver. Only 2,405 of the 22,935 employees surveyed were employed in the manufacturing establishments.

Chile

A total of 21 establishments which employ 46,089 workers were covered in the Chile survey. Eight of these were mining establishments typical of mining operations in Chile. Included were one coal mine, two nitrate mines, one sodium sulfate mine, and two copper mines and smelters. The eight mining establishments employed 34,552 workers, or 75 percent of all the workers covered by the survey.

The 13 manufacturing plants surveyed employed 11,537 workers of whom about 20 percent were women. Included in the variety of industries represented were: a fish cannery, a sugar refinery which also made industrial alcohol, two textile plants, one lithography and printing shop, two glassware plants, one ceramics plant, one plant making steel rods, another plant producing copper wire, and another producing stoves and other metal products.

OCCUPATIONAL HAZARDS

Health and safety consciousness was at a low level among management and workers in most of the mines, mills, and the manufacturing and service industries covered by the surveys. Working conditions described in this and following sections reflect this apathy.

In Chile, the author was impressed with the fact that the managers of the manufacturing establishments at least were not deliberately exposing their employees to health and safety hazards but were usually doing so unwittingly because of ignorance. A few industrialists felt that they made a sufficient contribution to social welfare by paying taxes and that anything else necessary should be done by the Government. It would be helpful if the Government itself would take the initiative in providing industrial hygiene and safety services. The fault has not been a lack of willingness on the part of the governmental agencies charged with this responsibility, but mainly a lack of sufficient funds and trained personnel.

MINES

Occupational health hazards in the mines in the three countries under observation were similar in many respects. The chief health hazards

were exposure to silica dust released during drilling, loading, and transportation operations; carbon monoxide in some mine galleries; sulfur dioxide in a few mines where ores were sulfide in character, as in Peru; fumes from blasting powder; and high humidity, particularly in the lower levels of the mines, and other temperature extremes.

The most serious of these health hazards was the exposure to silica dust which confirmed the high rate of silicosis among Bolivian, Peruvian, and Chilean miners.

Bolivia

The ore obtained from Bolivian mines surveyed contained free silica varying from 35 to 90 percent. The silica was present as amorphous quartz mineral and also as crystalline quartz. Most of the dust was produced during drilling, blasting, and waste removal operations.

Drilling was the mining operation which produced the greatest amount of dust. It was usually done with compressed air drills.

Although drilling was supposed to be done wet to cut down on dust hazards, dry methods were frequently used. Even though some miners employed wet methods, a single mine crew using dry methods in a section could heavily contaminate the air in the entire section. One or two of the mines had installed air washers in the main air courses, but these only partially reduced the dust contamination.

Air samples taken by members of the staff of the labor section during drilling operations indicated dust exposures varying from approximately 30 million particles (wet drilling) to 600 million particles per cubic foot (dry drilling).

Blasting operations were carried on during all development and stoping activities using 40 to 60 percent gelatin dynamite. During stoping operations, blasting was used not only to break the ore from the solid body, but also to break up large aggregates of mineral. Blasting produced much dust and, as a rule, took place at the beginning of the lunch hour or at the end of a shift. Lunch hour blasting, however, did not provide sufficient time for smoke and dust to clear.

In the mines surveyed, the ore was usually conveyed to the surface and to the mill for dressing. Waste materials were used to fill stopes. In these mines, the waste from crosscuts, drifts, and similar places was transported to the stopes and to other localities where it was needed. Generally, transportation was effected by vertical or horizontal means, and often by both methods. For vertical transfer downward gravity was usually employed either by raises made especially for the purpose, which connected levels with levels, or by stopes, which had shafts or ore chutes, similar to raises but connecting to the main level. Transportation methods were of mechanical and manual types. In the large mines, locomotives and haulage equipment were commonly used for horizontal transportation and skips for vertical transportation. The small mines used hand trams.

Dust was released in all parts of the mines during rock removal and during transfer, but by far the largest amount of dust was produced during mucking or loading operations. A great deal of dust was also produced when ore was transferred from raises and ore chutes to cars. When mechanical methods were used in mucking dry ore, the dust was very excessive. For example, some of the dust counts made in typical mines showed concentrations of about 50 million particles per cubic foot during stope filling, 90 million particles during mechanical mucking, and 271 million particles when ore was transferred from loading chutes to cars. Concentrations of 50 million particles were found during mucking operations. On the other hand, some concentrations of only 5 million particles per cubic foot were obtained during loading operations when the ore had been thoroughly wetted down.

Illumination in the mine workings came mostly from electric or carbide lamps worn by the miners. Miners had to depend on natural ventilation through various shafts in the workings. In some of the lower levels the ventilation was very bad. Unguarded machinery in all of the mines and mills caused many serious accidents. Floors in the mills were all in bad condition, and generally wet. Most stairways and platforms were unguarded, and those that did have railings were in need of repair.

In a good many of the mines transportation was by trolley. Low trolley wires were unguarded, and many switches were hazards.

Peru

At present, no data are available as to the amount of free silica in the various ores nor have any dust studies ever been made in Peruvian mines. However, some information is available to indicate that free silica is present in the ores and, in some instances, in high concentrations. In many of the mines, it was not necessary to make dust determinations to know that miners were breathing high concentrations of dust, since the amount of dust created in some of the mines was great enough to be visible to the naked eye.

Drilling was one of the mining operations which produced great amounts of dust. Most of the drilling was accomplished with compressed air and although drilling was supposed to be done wet, dry methods were frequently encountered. Invariably the collaring of holes was done dry. In most instances where wet methods were employed, it was apparent that an insufficient amount of water was fed to the hollow drill. The one gold mine visited, which was said to be typical of mines in the Southern area, was particularly dusty, since sufficient water was usually unavailable. In fact, the water used underground was brought to the mine in tins attached to ore buckets hauled over an 8 kilometer aerial cable.

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during mucking or loading operations. A great deal of dust was also produced when ore was transferred from raises and ore chutes to cars. When mechanical methods were used in mucking dry ore, such as in scraping operations, the dust was excessive.

With but one or two exceptions, mechanical ventilation was not employed in Peruvian mines. When mechanical ventilation was provided, it was obviously insufficient in quantity, and in one case it was completely ineffective because the system was not operating at the time of the visit. Natural ventilation was the rule and this was insufficient. Even when wet methods were employed, workers were still exposed to clouds of dust. Automatic air and water throttles were nonexistent, so that it was practically impossible to prevent dry collaring. Mine operators did not know how much water was fed to the drills, although scientific studies have indicated the exact amount of water needed for various types of drills and drill speeds. Blasting, which produced tremendous quantities of dust, took place during the lunch hour in all mines. There was not enough time between the noon-hour blasting and the miners' return to work for all the dust to settle. All of these factors were conducive to the inhalation of excessive amounts of silica dust, and the resultant rapid development of silicosis.

It may be of interest to note in passing that in the fall of 1945 the Sociedad Nacional de Mineria of Peru invited an eminent ventilation

Dry drilling in a coal mine

Lead furnace in insoluble anode plant of copper smelter

engineer of the Ontario Mining Association of Canada to study representative mines and mills in Peru and to make recommendations for the prevention of silicosis. The author of this report surveyed 10 of the mines and mills that had been visited by the Canadian engineer. In spite of excellent recommendations made by the Canadian concerning the prevention of silicosis, the author found that conditions in these 10 mines were about the same as they had been when he visited them nearly 2 years earlier.

Most of the mills where ore was concentrated were in as poor condition as the mines underground. Dumping and crushing of ore was done with few enclosures and no exhaust ventilation. On the whole, management in Peruvian mines has paid little attention to the control of dust at its sources, whether it be above or below ground. Although hundreds of thousands of dollars are now being paid out in compensation for silicosis, no company has tried to find out the composition or concentration of its dust exposures; to insist on wet drilling at all times; to provide mechanical ventilation where required; to use wet methods in other dust producing operations such as loading and dumping; or to make anyone responsible for the maintenance of control methods. Respirators used in some of the mines and mills were of the unapproved type and no maintenance services were offered when respirators were employed. Everything for compensation but nothing for prevention seemed to be the rule. Other pertinent observations on working conditions in the mines will be discussed later in this report, when the subject of occupational diseases is treated.

At this point, it may be well to discuss working conditions in the large and only smelter in Peru in somewhat greater detail. This smelter employed approximately 3,000 persons and produced some 12 different products, including lead, copper, and silver. In addition to the smelter itself, there were many maintenance shops essential to such operations.

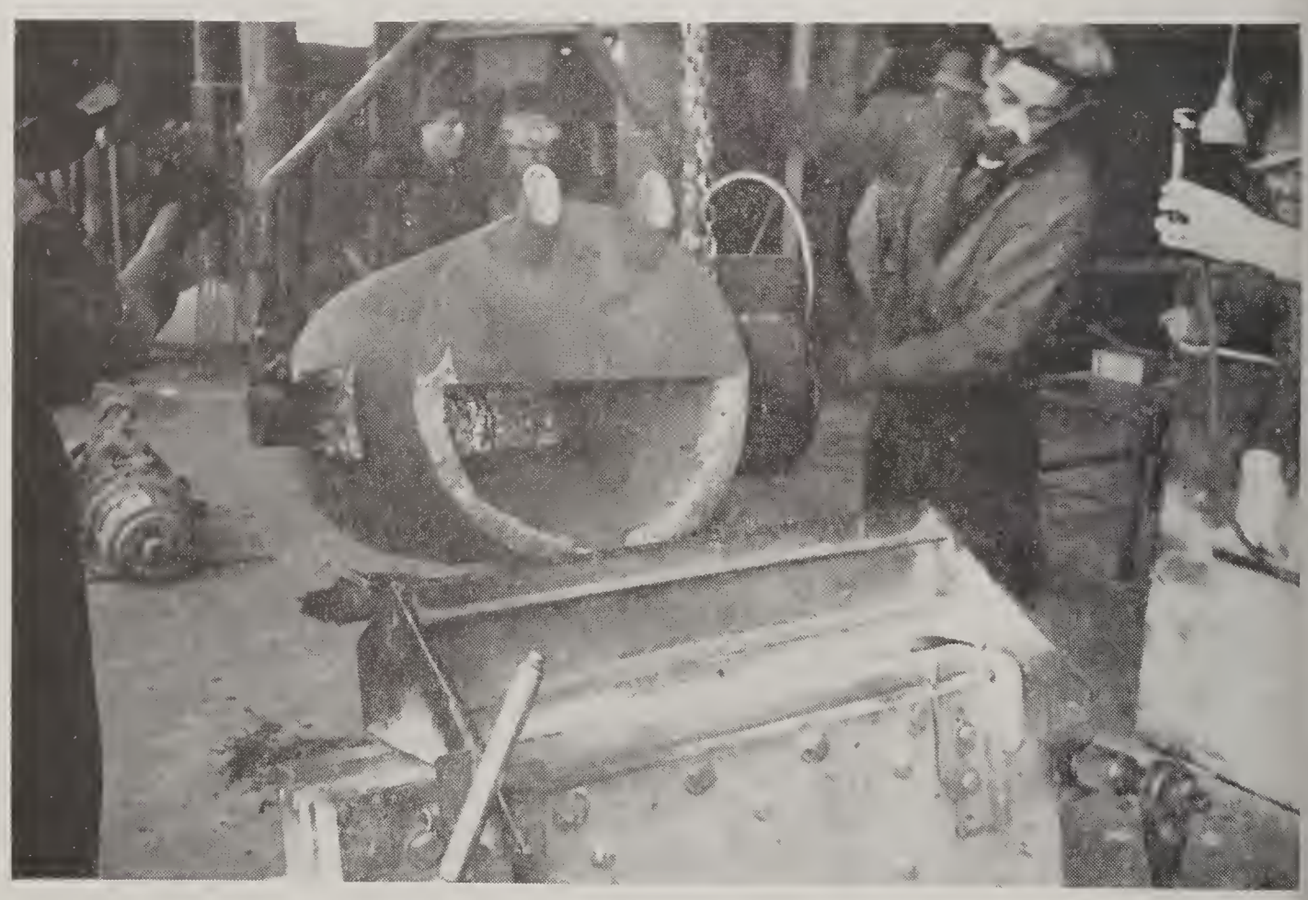
The *foundry* which employed about 80 men on one shift was a combination brass, steel, and iron foundry. Housekeeping in this shop was bad. On dusty operations, the men wore cloth bag respirators. Sand blasting was done outside the building but with no control. There was a definite potential silicosis hazard in this shop.

The *machine shop*, although offering no occupational disease hazards, contained many safety hazards from moving machinery, unguarded belts and gears.

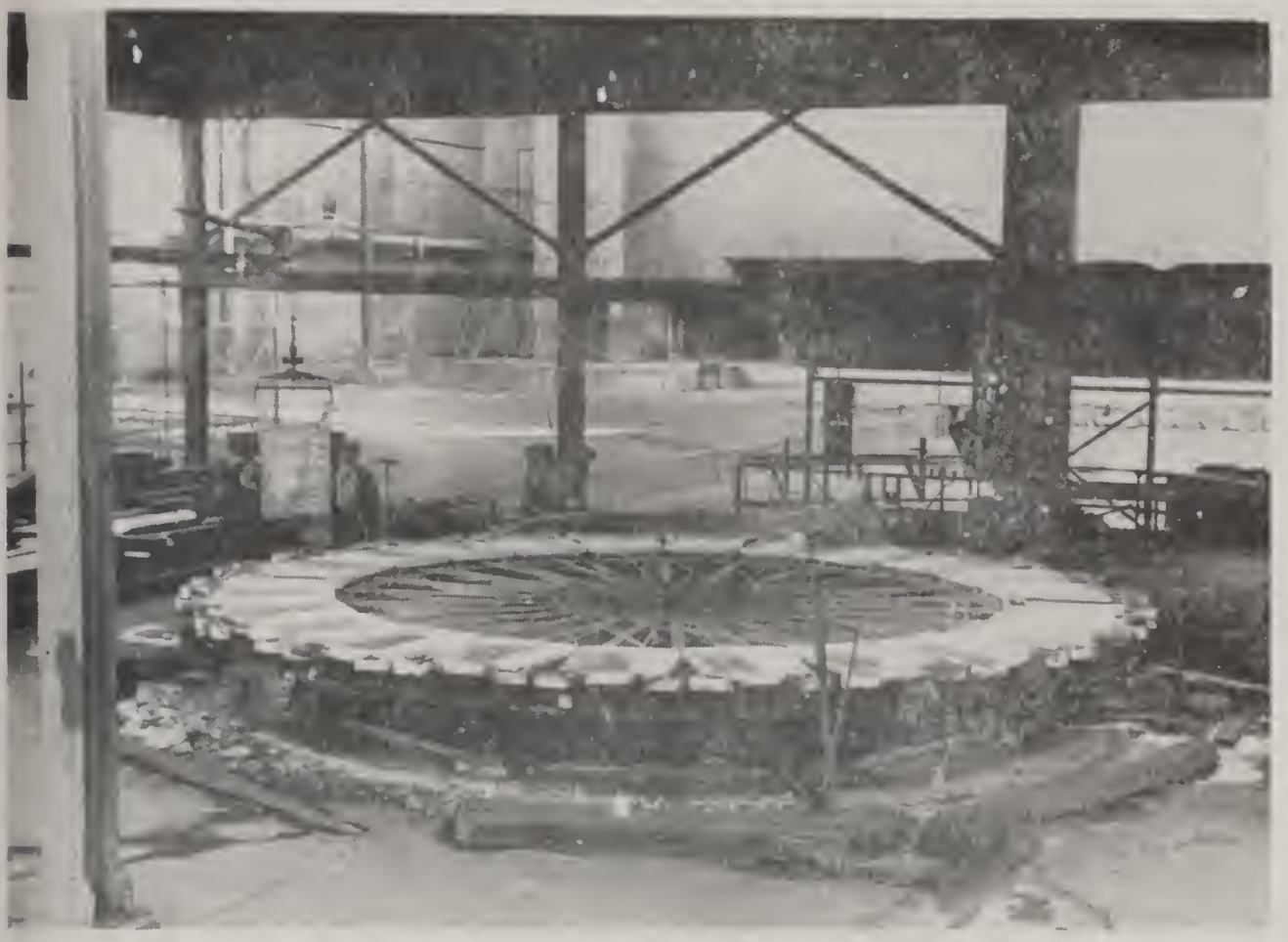
The *steel fabricating shop* contained welding, forging and rolling operations. It was observed that many workers who were welding did not wear goggles and that many of the welding operations were unshielded, thus exposing nonwelders to welding hazards.

The *carpenter shop* contained many accident hazards from unguarded moving machinery.

The *ore crushing and grinding department* handled about 2,000 tons of ore a day. Some of these ores contained as much as 75 percent total silica. There was absolutely no attempt made to control dust on such operations as dumping, crushing, grinding, and mechanical conveying, so that clouds of dust given off polluted the entire plant. Although most



Filling a mold with lead in a copper smelter



Lead cathode starter machine

workers were supplied with respirators and wore them, not a single respirator was of an approved type.

The *copper roaster,* nearby, gave off tremendous quantities of sulfur dioxide gas. Nearly 1,200 tons of this gas were discharged through the furnace stack every day and polluted the atmosphere.

About 12 people worked in the *arsenic department.* Although dermatitis cases occurred in this plant, it was claimed that no cases of poisoning occurred. Personal hygiene in this department was rather good on the whole. The men were furnished clean overalls, bathing facilities, and a separate lunchroom. However, case histories on some of these men showed symptoms suggestive of arsenic poisoning.

The *copper furnace* room also contained two lead blast furnaces. The operations in and about the lead furnaces were mostly unenclosed, so that there was ample opportunity for exposure to high concentrations of lead dust and fumes. This was especially true at the two lead sintering machines, which were observed to give off heavy clouds of lead oxide fumes. Other toxic lead locations were found around the lead furnaces, in the production of lead cathode starters, and in the lead rolling mill.

No cases of zinc oxide chills had been reported from the *zinc roaster department*, but the exposure should be studied.

There were potential hazards from hydrofluoric acid in the *hydrofluosilicic acid plant.* There was also a silicosis hazard in this plant, since the raw materials employed were free silica, fluorspar, and sulfuric acid.

There was also a potential silicosis hazard in the *brick manufacturing plant.*

This smelter contained many hazards to safety and health. The only exhaust ventilation installations observed were those in connection with coal pulverizing where it was necessary to protect the plant from dust explosions.

Handkerchief used as a protection against acid mist in a copper smelter

The *antimony plant* was also well controlled, but primarily in order to recover antimony. Housekeeping throughout the entire plant was very bad. One could not escape the conclusion that all this was but a reflection of the attitude of top management toward health and safety.

A company as large as this one, employing nearly 12,000 workers in all of its operations, would find it profitable, in the long run, to pay some attention to the control of occupational diseases. In fact, it would be of distinct monetary benefit to the company and a forward step in labor relations if management established a full-time industrial hygiene department, with responsibility to study and control occupational diseases. Such a department should be responsible only to top management, so that its recommendations would be put into effect expeditiously. As a start, it would be imperative for this company to employ immediately a trained industrial hygiene engineer who could begin to control the many toxic exposures now present in the smelter.

Chile

One of the two large copper mines visited in Chile had installed an excellent industrial hygiene and safety program within the 2 preceding years. In that mine, working conditions underground were excellent. Some 215,000 cubic feet of air per minute (approximately 270 c. f. m. per man) were moved. In addition to ventilation, many other dust control procedures were employed. The crusher plant associated with this mine was also well controlled from the standpoint of dust exposure. Four large fans, each with a capacity of 35,000 cubic feet per minute, were in operation. The dust exhausted from crushing operations was trapped in four air washers of the water spray type.

The other large copper mine made only a slight effort to control the silica dust exposure. The greatest source of dust was the gyratory crusher building which handled approximately 140 tons of ore per minute in its two 60-inch gyratory crushers. The ore was dumped out of two gondolas at a time, each holding 70 tons. The mechanism by which this ore was dumped into the crusher is shown in one of the accompanying photographs. Also shown is the tremendous cloud of dust created during this operation which was carried on, as a rule, from 3 o'clock in the afternoon until 7 in the morning. Considerable exposure to dust was also present in the open pit of the mine, where some 2,700 men were employed; at the various secondary crushers; and all the way through the plant up to the leaching vats. The dust at this mine contained approximately 50 to 60 percent silica in the form of quartz.

View of 2-car ore dumper

Cloud of dust created at 2 gyratory ore crushers (same mill)

One of the two nitrate mines covered in this survey maintained excellent conditions in its various crushing, grinding, and bagging operations. The other had no dust control program. It is true that the amount of quartz in nitrate ore is comparatively low; however, the dense clouds of dust liberated in the various crushing and pulverizing operations in the second nitrate mine should have been controlled if only to prevent accidents and damage to machinery.

Working conditions in the sulfate mine and mill were probably the worst encountered in the entire survey. Much dust was in evidence and the only controls employed were respirators of an unapproved type.

Serious hazards were found in the mills and smelters maintained by the copper mines including those associated with the copper mine which had instituted an industrial hygiene program. One smelter, which maintained a brick plant, had a serious silica dust exposure for which no control measures were in evidence. In addition, the smelters had exposures to sulfur dioxide, metallic fumes, and excessive heat from the furnaces. The various repair and maintenance shops, which were operated in connection with the mining establishments, were poorly equipped to handle both safety and health hazards.

On the whole, the survey revealed that some attempts to control occupational diseases and accidents had been made by two of the mining establishments and that the other establishments had a long way to go to achieve even fair working conditions. Perhaps this lack of health and safety consciousness on the part of the large concerns at least is due to the fact that until now the cost for indemnifying workers for

accidents or occupational diseases has not been prohibitive. However, in recent years silicosis rates (and apparently silicosis is about the only occupational disease recognized and compensated in Chile), and rates for total disability have increased. Production costs have risen sufficiently to make management give serious consideration to the improvement of working conditions.

MANUFACTURING INDUSTRIES

In general, it may be said that with the exception of a few of the manufacturing establishments surveyed, all of the industries in Bolivia, Peru, and Chile are about as backward in industrial hygiene and safety practices as were working establishments in the United States at the beginning of the present century. This is not hearsay evidence altogether, since the author of this report first began observing industrial hygiene practices in the United States some 28 years ago.

For example, in the manufacturing and service industries surveyed in Bolivia only three of the plants—the textile plant, the cement plant, and the airplane repair shop—could be considered modern. Some attempt was made to guard machinery and control hazardous operations, and fair sanitary facilities were provided.

Conditions in the remaining five Bolivian and in all Peruvian plants were not conducive to good health or safety. Illumination and general ventilation were inadequate. Machinery was completely unguarded. Electric wires were bare, and almost all hazardous operations were ineffectively controlled, or not controlled at all. Much of the machinery

Cleaning table in a small fish cannery

Flint grinding mill in a ceramic plant

was old and badly maintained and most of the power machinery was belt driven and unguarded. Grinding wheels were unguarded and unexhausted, nor were goggles worn by any of the men using these wheels.

Housekeeping was, in all cases, poor. Floors were wet and in need of repair. In several plants stairs were dark, steep, and unguarded. Some of the plants which had mezzanine work rooms had no guard rails on these mezzanine floors. Sanitation was grossly inadequate and badly maintained.

Bolivia

Specific exposures to toxic substances and materials were found to be typical of such manufacturing establishments. For instance, in the three Bolivian plants manufacturing shoes or processing hides, exposures were found to various dyes, solvents, oils, acids, and other chemicals used in hide treating and tanning operations. Some exposure was found to gasoline which was kept in open containers. In the textile plant, exposures to cotton dust and dyes were common. Humidity was high in the spinning, carding, and weaving rooms, and noise was excessive in the weaving room.

One of the worst plants visited in Bolivia was the glassware plant where observations were made during the night shift. Conditions in this plant are described here in detail, not because they were exceptional, but because they were typical of present-day manufacturing establishments in Bolivia.

The glassware plant contained about all the known health and safety hazards one can imagine. It was a typical sweat shop. Crowding was

especially hazardous in the manual blowing rooms. Little boys sidled and jostled each other carrying glass-blowing rods, the ends of which were molten glass, and constantly exposed themselves to burns. In the same room, though unshielded open furnaces and the glaring molten glass presented serious eye and heat hazards, workers had neither protective goggles nor clothing. Adequate air douches to combat the heat hazard were also lacking. In other parts of the plant, unguarded machinery and bare electric wires were all in need of corrective attention. Dust of a toxic nature was present in several of the other workrooms. The respirators furnished the workers in the batch mixing rooms were ineffective and badly maintained. In fact, it was just as well that the men did not wear them, since they would only have instilled a false sense of security. Needless to say, sanitary facilities were almost nil.

Peru

Of the four manufacturing plants which handled toxic dusts, such as silica and asbestos, only one made any effort to install dust control equipment. The remaining three had heavy exposures to dust. The cement plant could be spotted some distance away from its location, merely by the dust cloud which appeared on the horizon, even during a typical Lima winter overcast. In these plants, too, whenever respirators were worn, they were of the cheap, unapproved and ineffective variety. The textile mill which produced woolen cloth was very archaic. All machinery was unguarded, floors were wet and slippery and the few sanitary facilities available were at some distance outside the plant. Most of the women workers, of whom there were 350, were Indians and wore long braids and many layers of exposed clothing. Both are conducive to accidents from unguarded machinery.

Chile

Most of the products manufactured in Chile are light consumer goods for domestic consumption. The principal goods made are food products; textiles such as cotton, wool, rayon; chemical products; leather and leather products; and light machinery. World War II gave impetus to the production of manufactured products for home consumption; the assistance industry is obtaining from the Chilean Development Corporation is another factor in the recent growth of industrialization.

With the exception of a few enterprises, most Chilean industries are small and employ few workers. Heavy industry is a recent development. For this reason, the country suffers from a shortage of skilled labor and technicians.

It is apparent that Chile must conserve its manpower if it wants to compete with other countries which are rapidly developing industrially. To date, however, little has been done to conserve the health of workers

in manufacturing plants. With but one or two exceptions, conditions in manufacturing plants in Chile are as backward in health and safety practices as those observed in Bolivia and Peru.

OCCUPATIONAL DISEASES

Occupational disease legislation has been enacted in all three countries, but the emphasis is on compensation rather than on prevention. The compensation system in all three countries is characterized by certain weaknesses, both in the wording of the laws and in their administration. At the time of the studies, no reliable statistics on the incidence of occupational diseases in each of the countries were available, but sufficient evidence was found to indicate that such diseases occur frequently.

A characteristic of the compensation laws common to each of the countries under study is provision for payments for partial disability from silicosis. This is also one of the factors influencing high compensation expenditures for silicosis. This practice overlooks the fact that the medical profession does not have the exact scientific tools for evaluating partial disability from silicosis. The X-ray is a great aid in the diagnosis of chest conditions, but most authorities agree that in the field of silicosis it is an inadequate instrument for assessing disability from silicosis except in a gross manner. Neither is it possible to assess partial disability by daily work capacity, since that criterion varies with personal incentive, natural physical and mental endowments, and the nature of the job. Clinical criteria are also quite inadequate. A thorough study of all the factors involved is needed to arrive at a diagnosis of total disability. The problems involved in an attempt to assess partial disability are even greater.

In Peru there seems to be no consistency with regard to the handling of partial disability cases. For example, some concerns employ men underground with first and second stage silicosis while others pay total disability for silicosis in its early stages. In Chile, many concerns prefer to pay a worker for partial disability from silicosis rather than to keep him on the job and later be faced with a claim for total disability.

A far better approach to the silicosis problem would be to control the dust exposure to a safe limit and keep the man on the job. So long as he does not inhale more dust, his disease in the early stages should not progress. Only if infection sets in should he be indemnified for total disability and taken off the job. Experience in the United States has shown that, barring infection, a man with early silicosis is capable of doing a fair day's work, provided he is protected from exposure to dust. Indemnifying a worker for partial disability from silicosis does him harm rather than a favor, since he finds it difficult to procure employment elsewhere.

Bolivia

The only reliable statistics regarding occupational accidents and diseases in Bolivia are those of the Caja de Seguro y Ahorro Obrero, the governmental agency responsible for the national workmen's compensation fund. This fund is maintained by collections from industrialists in the form of a payroll tax. Compensation is paid to workmen insured with the Caja for certain classifiable occupational diseases and accidents according to a schedule set up by law.

The present occupational disease law provides for compensation for the pneumoconioses—silicosis, anthracosis, chalicosis, byssinosis, tabacosis, etc.; metallic poisonings; ophthalmic diseases; dermatoses; pulmonary sclerosis; nephritis; tuberculosis; and chronic bronchitis.

During 1946, the Caja insured 35,000 workers, and indemnified 11,603 of them for occupational accidents and diseases. Of this number, 231 workers received compensation for total disability from accidents, and 10,203 received compensation for partial or temporary disability, being paid anywhere from 50 to 100 percent of their wages for such injuries. In addition to these accidents, many more occurred which were not compensable by law, since they could not be classified as permanent or total, or temporary partial. In such instances, the worker received medical and hospital attention only.

The 10,434 compensable accidents cost 8½ million Bolivianos in actual cash. This sum represented only the actual compensation paid workers for accidents and did not include medical and hospital bills and intangibles, such as spoiled work, breakage of machinery, and other factors which have been estimated to cost four times as much as the actual compensation cost. In other words, work accidents alone really cost nearly 50 million Bolivianos in 1946.

The occupational disease picture was even more striking and tragic. In the same year, the Caja de Seguro indemnified 1,169 workers for occupational or professional diseases at a cost of 36 million Bolivianos in cash benefits. Thus, occupational diseases accounted for about 80 percent of the total payments made to workers. This percentage was in direct contrast with compensation figures in the United States, where benefits paid for occupational diseases account for only about 5 percent of all the money spent on compensation for all types of disability.

If all costs are considered, cash benefits as well as production losses, Bolivian industry has been spending somewhere in the neighborhood of 200 million Bolivianos a year for accidents and occupational diseases.

Disability in Bolivian industry is a costly affair not only in terms of human life and health, but also from the standpoint of economics. As a matter of fact, unless something drastic is done to curb these high accident and disease rates, manpower will soon be in short supply. About one-third of all the workers insured with the Caja were indemnified for some form of disability in 1946. Obviously, the total disability

cases were unemployable, since they presented insurance risks too great for an employer to take. Unemployable, also, were those who contracted silicosis, since totally disabling silicosis, that is, silicosis in the second and third stage, renders the worker uninsurable. Those workers who received partial disability compensation were also unable to work since preemployment physical examinations required by law weeded them out of the labor supply.

A few pertinent observations must be made in connection with these high disease and accident rates, not for the sake of exposing unholy practices, but in the hope that something constructive can be done to eliminate them.

Because of the low order of education among Bolivian workers, many of them deliberately exposed themselves to hazards. For example, many of them, in an attempt to contract first-stage silicosis (a compensable disease) refused to use the wet drilling methods required by law and internal regulations, even though water was right at their elbows.

Management could have fined a disobedient worker 20 percent of his wages for a maximum of 15 days for violating internal regulations. (The money received from these fines went to the Minister of Labor for the purchase of school books.) A miner, however, was not greatly disturbed by such fines, since he still had pulperia privileges. Management could also have imposed more serious penalties by laying off the worker for 3 or 4 days, during which he lost not only his pay, but also his pulperia privileges. Management, however, hesitated to penalize the men drastically because of the labor unrest which existed in the mines. The miners had issued a manifesto advocating workers' seizure of the mines. Mine labor was in a militant mood and not to be trifled with.

Peru

Although Peru has had an occupational disease compensation law since January 12, 1935, it is practically impossible to obtain nation-wide statistics on the incidence of occupational diseases. The reason for this paucity of data is to be found in the manner in which compensation for occupational diseases is administered. For example, if a worker believes that he is suffering from an occupational disease, he goes before the company physician who examines him. If he finds the worker's claim valid, the doctor certifies him to the company for payment. If the legal department of the company refuses to pay the claim, the worker has recourse to the local judge of the Ministry of Justice and Labor. If the claim fails to be adjudicated in the regional office of the Ministry of Justice and Labor, the worker's last recourse is the court in Lima. It is apparent, therefore, that whatever data are available are scattered and no attempt has been made, so far, to centralize the information. However, some idea of the incidence of occupational diseases

in Peru was obtained during this survey from the records of a few companies which collected such information.

The present occupational disease law provides disability payments for the pneumoconioses, and for poisoning incurred from exposure to mercury, arsenic, lead, bismuth, carbon monoxide, quartzite, calcite, cement, pitch, and hydrocarbons. Payment of indemnities for these causes, as well as for X-ray burns, is made on the same basis as for industrial accidents. In addition, acute or chronic pathological disorders, which may be brought on by the inhalation of noxious fumes or poisonous substances, are also considered on the same basis as industrial accidents. Two stages of disability are recognized for the pneumoconioses, namely, total and permanent disability and partial and permanent incapacity.

One firm which employs nearly 12,000 workers reported that 271 cases of silicosis were certified by its medical department for payment in 1946. This same firm also reported 16 cases of lead poisoning which occurred in its smelter that year. Two years previously the same firm had reported 25 cases of lead poisoning at its smelter. Forty-two cases of dermatitis occurred in this plant in 1946 and 17 during the first 6 months of 1947.

A total disability case in Peru costs 2,400 soles. A worker who receives total compensation is released. He is also entitled, by law, to service time payment amounting to 2 weeks' salary for each year worked. It is obvious that compensation payments were an expensive item in this particular company's budget. In fact, some half million soles ($80,000 at the official rate of exchange) were paid by this company for occupational disease compensation in 1946. In addition, this firm paid $60,000 a year in bonuses to workers exposed to lead hazards. This same firm also spent approximately $180,000 to operate its 135-bed hospital. No data were available on the amount of money this firm paid its workers because of general illnesses. Although not required by law, this company paid its workers half salary for the duration of any illness. Because of this extra expenditure, it was not possible to figure out the total amount of money spent by this firm for disability cases, but it certainly must have been close to a half million dollars a year. It was quite obvious that this company was wasting not only its own capital, but also that of its workers through loss in wages, ill health, and inefficiency. A modern preventive health program run by the company, under the leadership of the Government, is the only answer.

Other examples of occupational diseases in Peruvian industry are at hand. In one mine, which employed nearly 1,500 workers at its various installations, some 1,900 applicants for work were examined in 1946. Three percent of these were rejected because of silicosis, apparently acquired elsewhere. Another mine employing some 500 men examined 890 applicants for work during the first 6 months of 1947. Nine per-

cent of these men were rejected because of silicosis and 14 percent because of tuberculosis. Still another mine, employing about 450 men, reported that 8 percent of its workers had silicosis and tuberculosis. Another mine, employing 500 workers, reported 26.1 percent illness among its workers. The causes were pneumonia, grippe, bronchial pneumonia and silicosis. There were 84 cases of silicosis at this establishment. At this same mine 19 percent of 815 persons examined for employment in 1946 were rejected because of silicosis and tuberculosis. Of the 156 men rejected for these two causes, 128 had silicosis. And finally, the experience of still another mine was available for the period 1935 through 1942. During those 8 years, out of some 6,499 men examined, 14.3 percent were found to have silicosis. During the same period, only 1.9 percent of those examined were found to have tuberculosis.

It is obvious from the above data, even though they are from scattered sources, that high rates of silicosis and tuberculosis exist throughout Peruvian mines and mills. Unquestionably these rates are an underestimate, since it is known that a high labor turnover tends to mask true conditions. Labor turnover in the factories is slight, with the exception of one factory where it was reported to be 50 percent annually. But in most of the mines it is extremely high, running from 35 and 50 percent yearly to more than 100 percent, especially for unskilled labor.

It should be pointed out that there are many factors influencing the high labor turnover, among them being the fact that many of the unskilled workers like to return to their farms for several months of the year during planting and harvesting time. On the other hand, one cannot escape the fact that high turnover is due largely to bad working conditions, low pay, and extremely bad living conditions. Much has already been made of the fact that the men live in company camps where restrictions are placed on their freedom. Workers feel that no matter how bad living conditions are on their farms, at least they are in their own homes and enjoy a certain sense of stability and freedom.

At the present time, Peruvian mines are in dire need of labor and production is at a low ebb. This survey revealed that anywhere from two to three hundred men were needed at each mine and mill without exception. A simple computation reveals the fact that the mines in Peru could use thousands of men to produce minerals and other resources which are at hand and which would go a long way toward raising the standard of living and the prosperity of the nation. The present practice of running mines with silicosis hazards, paying off men with partial or total disability, and doing nothing to clean up hazardous conditions, only serves to deplete the nation's labor force. Apparently, something drastic must be done to eliminate the various evils discussed in this report, if production and purchasing power are to be raised.

Before leaving this section, it is only fair to point out that management has difficulties in obtaining full-hearted cooperation from the workers in its few attempts to control accidents and occupational diseases. Because of the low order of education of Peruvian labor, it is difficult to get many workers to use preventive measures, such as wet drilling. Labor is quite militant in Peru and is difficult to handle, even though the labor laws provide for disciplinary action when health and safety rules are broken by workers. Experience has shown that education is a far stronger weapon than discipline and it would pay management to inaugurate an educational program among its workers in the field of health and safety. Such a program has been found to be sound business practice in other countries.

Chile

Chile has had a law providing for compensation of occupational or professional diseases since 1927. This law is an extension of the law passed in 1925 for the compensation of accidental injuries, and provides that diseases developed in the course of employment be given the same interpretation as accidents. All wage earners, including agricultural and domestic workers, are covered by the law under a voluntary insurance system. A State Insurance Fund competes with private insurance carriers and employers who have the right of self-insurance.

The law grants total or partial disability compensation for professional diseases and accidents in accordance with the injury sustained. Compensation payments are provided for these illnesses: lead poisoning, mercurial poisoning, and intoxication produced by copper, antimony, zinc, chrome, barium, manganese, brass, gold, silver, tin, hydrocarbons, and sulfocarbons; diseases caused by infectious and parasitic agents, such as anthrax, carbuncles, glanders, actinomycosis, tetanus, and hookworm; diseases caused by the inhalation of dust, gases, and vapors; diseases induced by compressed air; diseases produced by toxic vapors of resins, tar, and its compounds; silicosis and other forms of pneumoconioses; cellulitis; synovitis; inflammation of the tendons; cataracts among glass workers; telegraph operators' cramps, nystagmus; diseases of the joints, muscles, and tendons; mental conditions; skin diseases; and diseases caused by exposure to alcohol and tobacco in industries which handle these two substances.

There are several deficiencies in the occupational disease compensation law as it is written and administered. It is obvious that little study of Chile's occupational disease problem preceded the formulation of the list of diseases to be compensated. The list reads as though it were copied from laws passed in other countries. Some of the diseases listed may never occur in Chile. A few are not occupational in origin; others, perhaps, should be added. Insofar as the practical application of the law is concerned, silicosis is about the only disease which is recognized

by physicians and compensation authorities and for which compensation is granted.

Because of the statistical system employed in the Labor Department and the State Insurance Fund which deals with accidents (Bureau of Labor Accidents) and because of incomplete reporting, it is difficult to determine the incidence of occupational diseases. For statistical purposes, little distinction is made between occupational diseases and industrial accidents. In 1946 the Bureau of Labor Accidents paid compensation for only 81 occupational diseases among its more than 300,000 insured workers. Other factors which preclude accurate statistics are high labor turnover, failure of physicians to recognize occupational diseases, and ignorance on the part of the workers.

It is well known that many workers with silicosis are still employed in industrial establishments, in which silica in the form of quartz is handled. For example, 15 percent of 1,000 copper miners examined in 1946 were found to have silicosis with varying degrees of disability. The company indemnified 62 cases that year. In the same mine, nearly 500 silicosis cases had been settled during the preceding 12-year period. Although dust hazards are now being controlled in this establishment, there are still approximately 150 men employed by the company who will eventually be compensation cases because of previous dust exposure.

In Chile, as was mentioned previously, the compensation law provides for payments for partial disability from silicosis.

Among other weaknesses of the present workers' compensation system are the low benefits paid to disabled workers, with the exception of those paid to workers with total disability from silicosis.

As has already been noted, little attention is paid to occupational diseases other than silicosis. Neither are there any special medical boards to decide on controversial claims for occupational diseases.

No credit is given to industry for improvements made in working conditions; management is thereby robbed of an incentive for maintaining a preventive program. There is no second injury fund in Chile to remove the burden created by the aggravation of a previous injury from industrial management. This is a serious deterrent to the employment of workers who have been injured, since employers are loathe to hire such poor insurance risks unless they are protected by a second injury fund. There is but a token amount of work being done to rehabilitate injured workers. The country is thus robbed of potentially productive workers and burdened needlessly from the point of view of welfare costs.

Perhaps the most serious flaw in the entire administration of the compensation law is the lack of an adequate program for the prevention of disability among workers. This will be treated further in the

discussion of governmental agencies which operate in the field of industrial hygiene.

SAFETY PROVISIONS

Although the elimination of safety hazards is not considered to be an integral part of an industrial hygiene program in most countries of the western hemisphere, the subject was considered during the present survey. In the few plants which had personnel responsible for safety practices, many obvious safety hazards were found to exist. Even in fairly new manufacturing plants, machinery was unguarded and poorly maintained. The extent to which safety provisions were made available to the workers in the establishments surveyed in the three countries is shown in table 6.

Table 6.—*Availability of safety provisions in all plants surveyed in Bolivia, Peru, and Chile*

Provision or service	Bolivia			Peru			Chile		
	All establishments	Mining	Manufacturing	All establishments	Mining	Manufacturing	All establishments	Mining	Manufacturing
Establishments surveyed	23	15	8	21	16	5	21	8	13
Workers included	26,488	23,774	2,714	22,935	20,530	2,405	46,089	34,552	11,537
	Percent of workers to whom service is available								
Safety director:									
Full-time	19	21	-------	55	60	7	53	68	8
Part-time	36	35	44	15	17	-------	-------	-------	-------
Shop committee	(1)	(1)	(1)	-------	-------	-------	31	42	-------
Health and safety committee	31	35	-------	-------	-------	-------	33	42	6
	Number of plants providing service[2]								
Safety director:									
Full-time	1	1	-------	8	7	1	6	5	1
Part-time	3	1	2	4	4	-------	-------	-------	-------
Shop committee	-------	-------	-------	-------	-------	-------	4	4	-------
Health and safety committee	1	1	-------	-------	-------	-------	5	4	1

[1] Organizing.
[2] Percent not computed because of small numbers.

Bolivia

In Bolivia, only one mine employed a full-time safety director. This person, however, did not spend his entire time on safety problems since he frequently served as a section boss in the mine. Three other establishments had part-time safety directors. Shop safety committees in these plants were nonexistent, although one tin mine and mill indicated that such a committee was being organized. In one mine, a health and safety committee functioned. Such committees have been found extremely useful in the control of health and safety hazards in some of the more highly industrialized nations of the world.

Peru

Eight establishments surveyed had full-time safety directors, and four plants employed them on a part-time basis. In none of the Peruvian industries surveyed were there such instrumentalities for the improvement of health and safety as shop committees or joint labor-management health and safety committees.

This lack of attention to safety was reflected in the accident experience of many concerns. One large establishment with a population of nearly 12,000 workers experienced 14 deaths and 1,006 lost-time accidents in 1946. This experience yields a frequency rate of 39.87 per million man-hours of exposure. One mine which employed 1,500 persons, and which had obvious safety hazards both above and below ground, experienced 1,410 minor accidents, 31 serious and 10 fatal accidents in 1946.

No current national statistics were available for accidents in mines, but data were at hand for 1944. In that year there was a total of 2,854 accidents in the mines and mills. For manufacturing plants, the latest data available were for 1945, when a total of 18,310 accidents was reported.

Chile

Although Table 6 indicates that five of the mining establishments and one manufacturing plant had full-time safety directors, only three companies employed men in this capacity. One of these companies operated a coal mine and a ceramic plant; another operated a copper mine, smelter, and repair shop; and the third, a copper mine and smelter. The first company held safety classes for workers; the other two had shop safety committees.

The one coal mine visited during the survey was reputed to be the best mine of that type in operation. However, safety hazards were found both underground and on the surface.

Health and safety committees functioned in one glass plant, in a copper mine and smelter, and in establishments of another copper company.

The lack of attention paid to the safety of Chilean workers is dramatically reflected in accident statistics for the year 1946. According to information obtained from the Labor Department, some 90,000 accidents occurred in Chilean industry that year. Manufacturing contributed nearly 30,000 accidents to the total; agriculture, approximately 16,000; and mining, 14,000. In other words, these three industries accounted for two-thirds of all accidents which occurred. In passing, it should be noted that agricultural workers sustained a relatively high number of accidents. Although accidents and occupational diseases are rarely associated with agricultural pursuits, problems of this character have been on the increase in these occupations largely

as a result of advances in farm mechanization and the increasing use of toxic insecticides. Experience all over the world indicates that just as much attention should be paid to industrial hygiene and accident control work for those engaged in agriculture as for those engaged in manufacturing and mining.

Chile's accident statistics in 1946 show that accidents and costs are on the increase. (Although occupational disease statistics are included with those for accidents in Chile's records, the former make up a very small part of the total.) In 1946, accidents increased 45 percent over 1945, and 37 percent over 1944. It is of interest to estimate the monetary cost of industrial accidents.

According to Labor Department statistics, approximately 90 million pesos were paid out in compensation alone. It is now well established through careful studies that the hidden costs of accidents, such as those involved in breakage of machinery, time lost by other workers when a fellow worker is injured, and other similar losses, average four times the compensation costs. In other words, the sum lost because of accidental injuries in Chile in 1946 was approximately 360 million pesos. To that sum must be added the cost borne by the nation because of loss of production. Some estimate of this sum can be obtained by an analysis of statistics furnished by the Bureau of Labor Accidents.

In 1946, this organization kept accurate data on 60 industries which employed 17,764 workers. In these 60 industries, accidents accounted for the loss of 68,699 work days. On the average, each worker in the 60 plants lost about 4 days a year because of accidents. If we apply this figure to the whole of Chile's labor force, we arrive at a loss of about 7 million work days a year. Taking an average wage of 30 pesos a day per worker and estimating that a Chilean worker produces goods valued at 170 percent of his wages, each worker may be said to produce 50 pesos of goods a day. Fifty pesos lost for 7 million days a year produces a loss of 350 million pesos of production value for the nation. Adding this figure to the 360 million pesos paid for compensation, it is evident that industrial accidents cost Chile some 700 million pesos annually.

At this point it may be of interest to make a comparison between accident experience in Chile and in the United States, where there has been an active preventive program for a good many years. In the United States accidents in industrial pursuits account for only 0.7 of a day of lost time per person per year. Even if we take into consideration the fact that occupational diseases are included along with accidents in Chilean statistics, we are still confronted with the inescapable fact that nearly six times as much time is lost from work because of accidents in Chile as in the United States. These figures are significant, since work accidents can practically always be prevented.

SANITATION FACILITIES

Sanitation facilities in Bolivian and Peruvian mines and mills, and in manufacturing establishments as well, are wholly inadequate and in a terrible state of maintenance. In some mining communities, workers have no facilities for the disposal of human excreta and use the neighboring hills for this purpose. Such practice helps to spread communicable disease, which is already prevalent throughout these countries. Water supplies, washing facilities, personal clothing lockers, and other sanitary facilities are completely lacking in many establishments and are entirely inadequate in others.

Chilean workers fare a little better in that sanitation facilities, though sometimes inadequate, are available to most of them. Toilet facilities, however, are generally insanitary; washing facilities are sometimes lacking; and clothing locker facilities are not always provided. A summary of the availability of sanitation and certain welfare facilities in all plants surveyed in each of the three countries is presented in table 7.

Bolivia

Sanitation facilities in the 23 plants surveyed were grossly inadequate. Three plants had no water supply at all. Public or private water supplies were available in 20 of the plants in which 97 percent of the workers were employed. In most instances, the water came from wells which were not of approved types.

Drinking facilities were available in 14 plants which employed 85 percent of the workers. Only two of these plants had drinking fountains. In the remaining plants, workers drew water from spigots and shared common drinking utensils.

Washing facilities were lacking in 10 mines and one factory. Nine plants, employing 55 percent of the workers, provided wash basins or sinks. Eight plants, employing 63 percent of the workers, supplied a few showers, but only one or two of these had hot water. Six plants, employing 13 percent of the workers, had running cold water, while six other plants, employing 53 percent of the workers, provided both cold and hot running water. In most instances, the plants provided neither towels nor soap.

Toilet facilities were available in seven manufacturing plants and in six mining and milling establishments. In the mines they were chiefly of the pit privy type. In general, these facilities were inadequate as to number and type, were located in foul, dank, and dark enclosures, and were revoltingly insanitary.

Sewage disposal facilities were provided in 12 of the 23 plants surveyed. Six plants had public disposal systems and six used private disposal methods.

Little attention was paid to other personal comfort facilities. Very

few plants provided workers with individual lockers. A few such lockers were found in four plants, which employed 8 percent of the workers. Two small plants had separate locker rooms. Only two mining establishments had lunchroom facilities for their workers.

Peru

Sanitation facilities in the 21 establishments surveyed in Peru were likewise grossly inadequate. Public water supply systems were available to four plants. The remaining 17 establishments, which employed the majority of the workers in the survey, were furnished water from private systems. In only one plant was the water filtered. In most instances the water came from unapproved sources, and in some of the mining camps the water supply was scarce.

No drinking facilities were available in seven establishments, employing 15 percent of the workers. Eight establishments, with 44 percent of the workers, had drinking fountains. In five establishments workers drew water from spigots, and in three others open buckets and carboys were used.

No washing facilities were available in 13 establishments, employing almost one-half, or 41 percent, of the workers surveyed. One of these establishments was a manufacturing plant, and the rest were mining enterprises. Seven plants, employing 43 percent of the workers, provided wash basins or had spigots available for washing purposes. Seven plants, employing 56 percent of the workers, provided some showers. Only two establishments, a mine and a smelter, provided both hot and cold running water, and two of the manufacturing establishments provided individual towels and soap. As a rule, towels and soap, when used, were provided by the workers themselves.

Toilet facilities in the plants and mines were even worse than those provided the men in their homes. Flush toilets were available in only two of the mining enterprises and in four of the manufacturing group of establishments surveyed. In the remaining 15 establishments covering 64 percent of the workers, facilities consisted of latrines, ditches or troughs, and cans underground. One large mine provided no underground facilities whatsoever. In general, these facilities were inadequate and grossly insanitary.

Only 3 percent of the establishments, employing 4 percent of the workers, had public sewage disposal systems, while six used private methods of sewage disposal. In the remaining 12 establishments (all in the mining group) which employed 48 percent of the workers, either no sewage disposal facilities were provided or open ditches were used for this purpose.

Lockers for street clothing were the exception rather than the rule. They were provided by three plants, employing 6 percent of the workers. Two of these plants were in the manufacturing group of

industries. One other plant was building locker rooms at the time of the survey.

Lunchrooms or space for eating at the work place were provided by four establishments and in four of the mines underground. These covered a little over one-third of the surveyed population. Seven establishments provided no space, although most of the workers ate their lunch at the work place. In six of the mining enterprises the workers went home for lunch, as did the mill workers in seven of the mining and milling establishments. One camp provided a dining room for single men where they could get three meals for one sole per day. One of the plants not only provided lunchrooms for its workers, but also served coffee at 4 o'clock in the afternoon. These were the only instances encountered in which management undertook supplementary feeding.

Chile

Sanitation facilities were provided in most of the 21 establishments surveyed in Chile.

Sewage disposal systems were available in all establishments studied. In one nitrate plant and at one copper mine and smelter the sewage was treated fairly thoroughly.

Public or private water supplies were likewise available in all the plants surveyed. In 10 establishments, employing 28 percent of the workers, drinking fountains were furnished. In 10 other establishments, employing a similar number of workers, the only drinking water available had to be taken from spigots, while in 4 mining establishments the workers carried their own water in canteens. Three establishments provided both fountains and spigots. Drinking utensils were usually of the common type.

Washing facilities were lacking in two mining and in three manufacturing establishments, which employed 26 percent of the population surveyed. Sixteen establishments, employing 74 percent of the workers, provided wash basins or sinks. Six mining establishments, employing 71 percent of the workers, provided showers with both hot and cold water. Two manufacturing plants provided cold showers.

Toilet facilities were provided in all establishments except one mine. These were of the flush type in 19 establishments, pit privy type in 1 mine, and chemical toilets in another mine. In general, these facilities were inadequate and insanitary.

Lockers were available in six mining and in nine manufacturing establishments which employed 72 percent of the workers. In one factory clothes hung on wall nails.

Feeding facilities at workplaces were provided in three mining and in one manufacturing establishment. No facilities were provided in 10 establishments; and in 7 others, the workers lived close to their homes and went home for lunch.

Table 7.—*Availability of sanitation and welfare provisions in all plants surveyed in Bolivia, Peru, and Chile*

Provision	Bolivia			Peru			Chile		
	All establishments	Mining	Manufacturing	All establishments	Mining	Manufacturing	All establishments	Mining	Manufacturing
Establishments surveyed	23	15	8	21	16	5	21	8	13
Workers included	26,488	23,774	2,714	22,935	20,530	2,405	46,089	34,552	11,537
	Percent of workers to whom service is available								
Water supply:									
Public	32	25	93	9	1	48	26	15	57
Private	65	71	7	91	96	52	74	85	13
Sewage disposal:									
Public	12	4	80	1	2	18	26	15	57
Private	56	60	19	48	44	82	71	85	43
Open ditch or none	32	36	1	48	54				
Drinking facilities:									
Fountain	5		48	44	47	15	28	23	41
Spigot	80	83	52	18	11	75	28	17	59
Canteens, other				23	24	11	45	60	
None	15	17		15	16				
Washing facilities:									81
Basin	55	50	99	43	42	55	74	71	
Shower	63	62	76	56	56	55	57	71	13
Cold water only	13	9	44	37	34	66	17		66
Hot and cold water	53	53	55	22	25		57	71	15
None	34	38	1	41	42	34	26	29	19
Toilet facilties:									
Flush	55	50	99	30	26	59	73	64	100
Privy, latrine, ditch	31	35		64	67	41	22	29	
None	14	15	1	6	7		5	7	
Lockers provided	8		81	6	5	15	72	71	73
Feeding facilities at workplace:									
Space provided	33	35		36	39	15	42	51	6
Space not provided	67	65	100	32	30	44	46	44	52
Workers eat at home	[1]	[1]	[1]	32	31	41	12	2	42
	Number of establishments providing service[2]								
Water supply:									
Public	9	2	7	4	2	2	10	1	9
Private	11	10	1	17	14	3	11	7	1
Sewage disposal:									
Public	6	1	5	3	1	2	10	1	9
Private	6	4	2	6	3	3	11	7	4
Open ditch or none	11	10	1	12	12				
Drinking facilities:									
Fountain	2		2	8	6	2	10	5	5
Spigot	12	6	6	5	3	2	10	2	8
Canteens, other				3	2	1	4	4	
None	9	9		[3]7	[3]7				
Washing facilities:									
Basin	9	2	7	7	1	3	16	6	10
Shower	8	5	3	7	4	3	8	6	2
Cold water only	6	2	4	8	1	1	8		8
Hot and cold water	6	3	3	2	2		8	6	2
None	11	10	1	[3]13	[3]12	1	5	2	3
Toilet facilities:									
Flush	9	2	7	6	2	4	19	6	13
Privy, latrine, ditch	4	1		15	14	1	2	2	
None	10	9	1	1	1		1	[4]1	
Lockers provided	1		1	3	1	2	15	6	9
Feeding facilities at workplace:									
Space provided	2	2		8	6	2	4	3	1
Space not provided	21	13	8	7	5	2	10	1	6
Workers eat at home	[1]	[1]	[1]	13	[3]12	1	7	1	6

[1] Not determined.
[2] Percent not computed because of small numbers.
[3] Includes mining establishments where provisions differ for underground and mill workers.
[4] Mine.

MEDICAL SERVICES

The availability of medical services in the establishments surveyed in each of the three countries is presented in table 8, which gives the proportion of workers provided with services and the number of establishments providing the service or facility. On the whole, the figures indicate a high percentage of facilities in groups of establishments under study, but the figures are for most part misleading when one takes into consideration the type of facilities provided. This is especially true in Bolivia and Peru, where medical services are grossly inadequate from the standpoint of quality and quantity. Workers in Chile fare considerably better as will be explained in the following discussions.

Bolivia

Some form of medical service was offered in all but three of the establishments surveyed and was available to 97 percent of the workers involved. Plant physicians, on a full-time, part-time or on-call basis, were retained by all but three of the plants. Ten mining and milling plants, employing 86 percent of all workers surveyed, had full-time physicians. No full-time physicians were found in any of the manufacturing or service industries. Two mines and mills and four manufacturing plants employed part-time physicians. Four other manufacturing plants had physicians on call. Sixteen percent of all the workers surveyed were covered by these part-time services.

Preplacement examinations were given in all but two establishments. Periodic examinations, however, were given in only three of the plants, and, in those, only upon a worker's request.
These plants employed 66 percent of all the workers surveyed. Part-time nursing services were never used.

First-aid facilities were available to a large proportion of the workers surveyed. Seventeen plants, employing 82 percent of the workers, had first-aid rooms; 15 plants, employing 89 percent of the workers, had first-aid kits; and eight plants, employing 62 percent of the workers, employed trained first-aid workers. These facilities were fairly well distributed among the mining and manufacturing groups.

Evidence of hospital facilities made available to workers by their employers was also found. Two types of hospital facilities were observed, company-owned hospitals and contract hospitals. Seven of the mines, employing 87 percent of the workers in this group of industries, operated their own hospitals. Another mine, employing 3 percent of the workers, had a contract with a private hospital for the hospitalization of its workers. Four manufacturing plants, employing 78 percent of the workers, had similar arrangements. In other words, hospital facilities were available to 89 percent of the workers included in this survey.

Dental services were available to 86 percent of the workers. Five mining establishments employed full-time dentists, while three others retained part-time dentists, as did three of the manufacturing establishments.

Nursing services, on the other hand, were less common. Nine mines and mills and two manufacturing plants had nurses on full-time duty.

Table 8.—*Availability of medical provisions and services in all plants surveyed in Bolivia Peru, and Chile*

Provision or service	Bolivia			Peru			Chile		
	All establishments	Mining	Manufacturing	All establishments	Mining	Manufacturing	All establishments	Mining	Manufacturing
Establishments surveyed	23	15	8	21	16	5	21	8	13
Workers included	26,488	23,774	2,714	22,935	20,530	2,405	46,089	34,552	11,537
	Percent of workers to whom service is available								
Hospital:									
Company owned	78	87	-------	87	98	-------	77	98	13
Other arrangement	11	3	78	6	2	45	-------	-------	-------
First-aid room	82	82	86	98	98	100	98	100	91
First-aid kit	89	89	92	100	100	100	100	100	100
Trained first-aid worker	62	60	84	96	96	93	98	100	91
Physician:									
Full-time	86	96	-------	87	98	-------	77	98	13
Part-time	11	5	61	10	-------	93	37	29	62
On call	5	-------	47	3	2	7	6	-------	25
Nurse:									
Full-time	66	68	48	92	98	41	93	100	72
Dentist:									
Full-time	55	62	-------	55	62	-------	45	56	13
Part-time	31	28	56	9	10	-------	41	42	39
On call	-------	-------	-------	8	7	18	3	-------	11
Physical examinations:									
Preplacement	99	99	100	97	98	93	95	98	86
Periodic	8	4	42	39	41	18	67	71	55
X-ray included	[1]	[1]	[1]	24	27	-------	77	98	15
Medical care provided families of workers	87	97	-------	62	69	-------	78	98	28
Environmental hygiene program	55	56	44	2	-------	18	15	17	6
	Number of plants providing service[2]								
Hospital:									
Company owned	7	7	-------	14	14	-------	9	7	2
Other arrangement	5	1	4	3	1	2	-------	-------	-------
First-aid room	17	12	5	20	15	5	19	8	11
First-aid kit	15	9	6	21	16	5	21	8	13
Trained first-aid worker	8	3	5	18	14	4	19	8	11
Physician:									
Full-time	10	10	-------	14	14	-------	9	7	2
Part-time	6	2	4	4	-------	4	8	2	6
On call	4	-------	4	3	2	1	5	-------	5
Nurse:									
Full-time	11	9	2	16	15	1	16	8	8
Dentist:									
Full-time	5	5	-------	4	4	-------	5	3	2
Part-time	6	3	3	4	4	-------	8	4	4
On call	-------	-------	-------	4	2	2	2	-------	2
Physical examinations:									
Preplacement	21	13	8	19	15	4	17	7	10
Periodic	3	1	2	5	3	2	13	6	7
X-ray included	[1]	[1]	[1]	2	2	-------	10	7	3
Medical care provided families of workers	11	11	-------	6	6	-------	11	7	4
Environmental hygiene program	4	2	2	2	-------	2	4	3	1

[1] Not determined.

[2] Percent not computed because of small numbers.

With the exception of one or two hospitals which were well staff and equipped, most of the facilities available to the mine and m workers in Bolivia were completely inadequate by ordinary standard One mine, which claimed it had a hospital, made no provisions f separate rooms for men and women, and had no instruments or medic equipment.

Peru

According to Peruvian law, all mines and mills which have a sta of 50 or more and are situated more than 30 hours from a reside certified physician, must have a staff physician residing permanent on the site. Those establishments with 100 or more persons must pr vide dental consultation at least weekly, and if the personnel is 1,5 or more a permanent dental service must be provided. Establishmen employing more than 2,000 persons in a locality where no hospital available within 50 kilometers must provide a hospital. Those min with less than 50 persons must provide at least a medicine chest an a male nurse trained in first-aid.

Medical services on full-time or limited basis were offered in all b one of the establishments surveyed. In the factories, however, th medical services were of a part-time character.

Hospitals were owned and operated by 14 establishments in th mining group of industries, covering 87 percent of the workers. On construction project had hospital arrangements with the Servicio C operativo Inter-Americano de Salud Publica, and two of the man facturing plants had arrangements with the National Social Insuran Fund for hospitalization of their employees.

A total of 35 full-time physicians were employed in the mining i dustries surveyed. These were chiefly employed in connection wi hospitals operated by these companies. However, two mining camp employed physicians on an "on call" basis. No full-time physician were retained by any of the five manufacturing plants. Four of the retained physicians on a part-time basis and one on an "on call basis.

Full-time nurses were employed by 15 establishments in the minin group and by one plant in the manufacturing group. Very few traine nurses were observed with the exception of those employed in the larg hospitals maintained by two large mining concerns. Most of th medical assistants were practical nurses, or practicantes, as they ar called. Most of the smaller mines, that is those employing less tha 500 persons, had hospitals with anywhere from 6 to 10 beds, but thes could only be classed as first-aid stations. As a rule, these hospita were poorly equipped and the one doctor in attendance not only ha to take care of all the workers, but their families, too. For exampl one mine, employing nearly 1,500 persons, of whom 800 worked unde ground, had only one physician in attendance who looked after all th

workers and their families. This meant that one physician had to look after six or seven thousand people with only three practicantes to assist him. The hospital was extremely inadequate and insanitary. It contained just 10 beds, which had no springs or mattresses, but merely planks. Sick people had to bring their own bedding.

There were few exceptions to this state of affairs. On the whole the medical and hospital facilities provided most of the workers in the mines visited were grossly inadequate. Furthermore, the physicians in these localities were so overworked that about all they had time to do was to render first-aid and emergency medical care. In only one plant, one belonging to the Government, was there a physician who also had responsibility to do something about the prevention of occupational diseases and illnesses.

First-aid facilities were provided in practically all establishments surveyed. The construction project did not have a first-aid room nor a trained first-aid worker, but it did have a first-aid kit. One coal mine and a glass manufacturing plant had no trained first-aid workers, but the former employed several practical nurses and maintained a hospital. Some of the mines had underground first-aid stations.

Although physical examinations before employment are required by law, two establishments did not comply with this provision. Periodic examinations were only conducted in two factories and in three mining establishments. In spite of the fact that silicosis is a major health hazard in the mines of Peru and the X-ray a valuable tool in the diagnosis and medical control of this disease, only two mines utilized the X-ray during preemployment examinations. Another was planning to do so. As a result, most of these establishments were hiring some men who unquestionably were already silicotic. One would expect that some of these plants would at least install an X-ray machine for their own protection so as to weed out silicotics who might put in a claim later.

Few establishments gave dental services as required by law. Eight establishments in the mining group, employing 64 percent of the workers, maintained full-time or part-time dentists. Two other establishments in this group and two in the manufacturing group had dentists on call, but in most instances these services were not in existence.

Chile

Chile has had medical care, social security, public health, and social welfare programs since the passage of its famous Law 4054 on September 8, 1924. This law covers practically the entire working population. No attempt will be made in this report to discuss the ramifications of Chile's social security system, since this has been done adequately by many students of the problem. An attempt will be made to indicate

how the social security benefits provided impinge on the health ar welfare of industrial workers.

Medical services and plant dispensaries required by Law 4054 we available in all but two of the establishments surveyed—the canne and the printing shop. In these two plants a physician was availab on an "on-call" basis, but no other medical facilities were provide Full-time plant physicians were retained by seven mining and tv manufacturing establishments covering 77 percent of the survey population. These establishments owned and operated their ov hospitals.

Part-time physicians were employed by two mining and six man facturing establishments, and in the remaining five manufacturi plants the physicians were on an "on-call" basis. These physicians we usually supplied by the Workers' Compulsory Insurance Fund.

Nurses were employed by all eight mining and by eight of the manufacturing establishments for hospital work and for plant d pensaries. These services were available to 93 percent of the worke surveyed. A few of the large companies employed other medical perso nel, such as technicians and pharmacists. The hospitals operated some of the large mining concerns were well equipped, staffed a maintained.

Full-time dentists were employed by three mining and two man facturing establishments. Part-time services were provided in eig establishments, while in two others dentists were "on-call."

First-aid facilities, including a first-aid room and trained first-a workers, were available in all but two of the plants surveyed. Fir aid kits were available in all the establishments.

Chile's Preventive Medicine Law, which was enacted early in 19 provides for free periodic compulsory medical examinations f workers. The law is administered by the Workers' Compulsory Insu ance Fund.

Preplacement physical examinations were given in all but four the establishments surveyed and reached 95 percent of the worke Periodic examinations were given for employees in 13 establishmen employing 67 percent of the workers. Chest X-rays were included the physical examinations given in 10 establishments, employing percent of the workers. One mine took X-rays of all workers who h worked in other mines and made stool examinations on miners comi from mines where hookworm was known to be prevalent.

The practice with regard to periodic examinations differed fro plant to plant. Usually they were given annually. In two establis ments such examinations were voluntary. One company reexamined i old workers two or three times a year, while a glassware plant wi a definite silicosis hazard examined its men twice a year.

In eleven of the plants surveyed medical services were also provid for workers' families.

It is pertinent to the present discussion to note that the Preventive Medicine Law is in principle perhaps the finest social law which the country has passed. From the standpoint of industrial hygiene, however, there is a weakness in its application. The law does not utilize the physical examination as an aid toward the proper placement of the worker. In reality, an examination made under the provision of the law is a periodic examination and not a preemployment or preplacement examination. Most often, except in large concerns which employ physicians on a full-time basis, preemployment physical examinations are given by physicians employed by the Workers' Compulsory Insurance Fund. These physicians are unacquainted with the specific requirements of jobs in industrial plants. In fact, it is doubtful if many of them have ever stepped inside such a plant. As a result, they are not able to utilize the physical examination as a means of placing the worker in the right job. In the United States and in Great Britain this technique has been developed into a useful tool and is a new approach, particularly in regard to the employment of persons who are physically handicapped. In the past a person's handicaps were listed by the physician and sent to the employment department. Today the practice is to list a person's abilities and to match them with the physical and mental requirements of a job. In this manner, every prospective worker has an opportunity for useful employment. Such an approach is especially to be commended to a nation like Chile which needs every trained person it can muster.

Another aspect of Chile's medical care program deserves mention. Although close relationships are maintained between the various social insurance funds and the Ministry of Health, Social Insurance and Social Assistance, these relationships apply only to the administration of the funds and not to the substantive aspects of a public health program. The agencies concerned with social insurance and assistance maintain their own medical and professional staffs, and make little use of the technical staffs of the public health agencies. Much work of mutual benefit can be done cooperatively by the Public Health Department and the social insurance funds, especially in epidemiology, health education, and specific preventive health services. A cooperative program has been attempted in the field of venereal disease control but has not been carried over into other public health activities.

SICKNESS BENEFITS

A summary of the availability of sickness benefits and disability records in the establishments surveyed in each of the three countries is shown in table 9. Some form of sickness benefits is compulsory in each of the three countries. As the situations differ, each country will be discussed separately.

Table 9.—*Availability of sickness benefits and records in all plants surveyed in Bolivia, Peru and Chile*

Service	Bolivia			Peru			Chile		
	All establishments	Mining	Manufacturing	All establishments	Mining	Manufacturing	All establishments	Mining	Manufacturing
Establishments surveyed	23	15	8	21	16	5	21	8	13
Workers included	26,488	23,774	2,714	22,935	20,530	2,405	46,089	34,552	11,537
	Percent of workers to whom service is available								
Sickness benefits:									
Supplemented by:									
Management	-------	-------	-------	91	96	66	11	-------	45
Management and union	-------	-------	-------	4	-------	34	1	-------	5
Union	-------	-------	-------	-------	-------	-------	40	54	-------
Paid by management	95	95	100	-------	-------	-------	-------	-------	-------
Disability records kept on:									
Accidents	[1]	[1]	[1]	76	82	25	88	100	54
Occupational illness	85	84	100	76	82	25	87	98	54
Nonoccupational illness	8	7	19	79	82	59	33	32	36
	Number of plants providing service[2]								
Sickness benefits:									
Supplemented by:									
Management	-------	-------	-------	19	15	4	5	-------	5
Management and union	-------	-------	-------	1	-------	1	1	-------	1
Union	-------	-------	-------	-------	-------	-------	3	3	-------
Paid by management	19	11	8	-------	-------	-------	-------	-------	-------
Disability records kept on:									
Accidents	[1]	[1]	[1]	17	14	3	16	8	8
Occupational illness	14	6	8	17	14	3	15	7	8
Nonoccupational illness	3	1	2	18	14	4	9	4	5

[1] Not determined.
[2] Percent not computed because of small numbers.

Bolivia

According to Bolivian law, owners of mines and industries who employ more than a specified number of workers must pay sickness benefits to their employees for nonoccupational illnesses. A worker who has been employed from 3 to 6 months is entitled to one-fourth of his pay up to a maximum of 15 days. If he has been employed from 6 months to a year, he is entitled to half his pay for 15 days. Day workers employed more than a year are entitled to 1 month's pay during nonoccupational disability. Salaried employees may obtain sickness benefits up to a maximum of 3 months' pay, if they have been employed more than 1 year. Nineteen of the establishments surveyed, in which 95 percent of the workers were employed, offered these sickness benefits and hospitalization covering nonoccupational illness and accidents.

Although 19 plants paid nonoccupational sickness benefits, only three plants kept records of these illnesses. There were, therefore, no accurate data available as to the extent or cost of nonoccupational illness.

Peru

The compulsory social insurance scheme providing benefits for sickness, maternity, invalidism, old age, and death, established by law in Peru in 1936, is now regulated by a decree promulgated in 1941. Compulsory insurance applies to all persons from 14 to 60 years of age who habitually work for an employer and whose annual wage does not exceed 3,000 gold soles. Certain classes of workers, such as Government employees, are excluded from the law. The funds are made up of contributions from the workers (1.5 percent), employers (3.5 percent) and the State (1 percent).

In order to receive sick benefits under compulsory insurance, the beneficiary must have paid four weekly contributions in the four months preceding sickness. Benefits which start from the third day of illness may continue for 26 weeks, and in protracted illness up to 52 weeks. Medical, hospital, and limited dental services are furnished free. In addition, 50 percent of the average daily wage is paid as cash benefits during the first 4 weeks of illness and 40 percent thereafter. The fund also provides maternity benefits and invalidism benefits when the earning capacity of the worker has been reduced by two-thirds. Old age and death benefits are also provided.

The program is administered by the National Social Insurance Fund and managed by an advisory board. Workers' hospitals where treatment under this law may be obtained were in operation. The finest of these was the one in Lima which opened in 1940. This was 1 of a network of 12 hospitals which the social insurance fund was constructing. Unfortunately, several of the hospitals constructed by the Fund have not been fully completed inside and lack essential equipment. As a result, many workers in Peru had to put up with the inadequate services provided by some of the industrial establishments.

All workers in the plants surveyed received sickness benefits as required by law covering hospitalization, occupational and nonoccupational illnesses, and accidents. In 15 of the mining establishments the workers received additional cash payments from management to supplement the amounts provided by the National Social Insurance Fund. In four manufacturing establishments supplementary sickness benefits were furnished by management and in one manufacturing plant by management and the union.

Disability records on accidents and occupational illness were kept by 17 establishments, employing 76 percent of the workers. Records on nonoccupational illness were maintained by 18 establishments, employing 79 percent of the workers. As a rule, these records were inadequate and did not furnish reliable data on the extent of illness among the workers and their families.

Nearly all employed persons in Peru come under the National Social Insurance Fund. Disability records, therefore, were maintained for

all of them. However, it was just as difficult to obtain nation-wide statistics on sickness as it was on accidents and professional diseases. Sufficient scattered data were obtained to indicate that sickness among employed persons in Peru was a real problem and one which resulted in large monetary losses due to absenteeism.

One large mining concern, employing 5,000 persons, experienced 689 cases of illness during 1946 with a total loss of time from work of 6,875 days. Another large establishment, employing approximately 2,400 persons, stated that its sickness absenteeism amounted to 2 percent. Perhaps the best information covering the fairly large group of employed persons was that obtained from the Obrero Hospital in Lima, which is maintained by the Caja Nacional de Seguro Social. The records of this Hospital showed that in 1946 it had 106,318 workers on its beneficiary rolls. The lost time among this group for that year totaled 998,960 days. This yields an average of approximately 9.4 days per person per year, a rate considerably higher than that experienced in the United States, where the average days lost from just sickness is about seven per person per year.

It would be helpful if the National Social Insurance Fund could maintain more adequate and complete records, so that it could analyze its experience and, on the basis of its findings, launch a preventive program. Or at least it might provide leadership to help the public health authorities and the industries of the nation conduct such a program.

Chile

Nearly all workers in Chile are entitled to sickness insurance under the Compulsory Insurance Law. It was found, however, that sickness benefits required by law, which entitle a worker to medical, surgical, pharmaceutical and dental care and hospitalization beginning with the first day of illness and lasting 26 weeks, do not entitle him to full weekly salary payments, except for the first week of illness. In five of the manufacturing plants, employing 11 percent of the workers, cash benefits were supplemented by management; unions supplemented payments in three mining establishments, employing 40 percent of the workers; and management and the union jointly supplemented payments in another manufacturing plant. The amount of supplementation varied—one plant added ten pesos daily to the fund, while another added 15 pesos daily. In one textile plant, management stated that it paid out 50,000 pesos annually for this purpose, while in a glassware plant, management made up the difference between what the workers received and his full salary.

Five manufacturing establishments kept no disability records. The other 16 establishments maintained records on accidents; 15 had records on occupational diseases; and 9 on nonoccupational illnesses. Records of nonoccupational illness were very meager, but they did in-

icate a high tuberculosis rate. In general, disability records were either extensive, uniform, nor adequate.

Fairly reliable statistics on sickness among workers can be obtained rom the records of the Workers' Compulsory Insurance Fund. Unquestionably, workers' illnesses are the most important cause of lost me and production.

Data are available on 836,505 physical examinations made from 1938) 1945, inclusive. During these 8 years, 50,824 persons (5.9 percent) ere found to have tuberculosis; 55,437 (6.4 percent) had venereal isease; and 37,513 (4.3 percent) were suffering from cardiovascular iseases. In other words, about 16 percent of those examined were ffering from these three serious conditions alone. Emphasis is placed these three diseases because the law provides total or partial preentive rest with full wages for a period of time determined by the ossibilities of reemployment for persons found to have them. Special edical boards determine a worker's rights to a rest cure.

In 1946, 1,200,000 persons were insured with this agency. Payments ere made for 4,500,000 days of time lost because of illness, including ronic illnesses which required rest cures.

If one makes a correction for the fact that the Fund requires a 4-y waiting period, it is found that the average worker in Chile loses out 7 days a year because of sickness. Applying this figure to the tal labor force in Chile, we arrive at a yearly production loss from ness of 12,250,000 man-days. Using the figure of 50 pesos a day which as employed in the discussion of accidents, we find that 612,500,000 sos are lost yearly to the national income because of illness. Add this the cost of operating the Fund itself, and we arrive at a tal annual monetary loss because of illness of 1,250,000,000 pesos. his figure is actually an underestimate, since some half million persons e not insured with the Fund. If we add the monetary loss caused by ness to the loss previously cited for accidents and professional seases, we are confronted with the fact that some 2 billion pesos are st in Chile every year because of disability experienced by its labor ree. This sum represents ten percent of the present national income Chile and constitutes one-third the national budget.

It is obvious from the foregoing that time lost on the job because illness and accidents in Chile is a serious problem from several ints of view. The task of improving the health status of Chilean rkers must be attacked from two sides at once—through the workace and the community.

V. Current Activities Concerned with Industrial Hygiene

In the three countries under study it was found that several officia and nonofficial agencies have a legal responsibility or an interest in th field of industrial hygiene. Since any permanent industrial hygien and safety program that may be established should take advantage o every available resource in existence, the survey included a study o all agencies which might have some bearing on the problem.

OFFICIAL AGENCIES

Bolivia

Although on May 8, 1946, the Villarroel Government promulgate a decree establishing an industrial hygiene inspection service, th decree was never implemented. As a matter of fact, the Governmen in power in March 1947, was the third Government which failed t implement it. As a result, no official industrial hygiene and safet division existed in Bolivia at the time of the survey here reported.

It was found, however, that several official agencies were engaged i activities which were directly or indirectly related to industrial hygien and safety.

The activities of the following official agencies were studied durin the survey: Dirección General de Sanidad (Department of Health) Inspección General de Trabajo (Department of Labor), and Caja d Seguro y Ahorro Obrero (Workmen's Compensation) all agencie within the Ministerio del Trabajo, Salubridad y Prevision Socia (Ministry of Labor, Health and Social Welfare, later replaced by tw separate ministries); Dirección General de Minas y Petróleos (Depart ment of Mines); and the Servicio Cooperativo Inter-Americano d Salud Pública (SCISP) (Inter-American Cooperative Public Health Service). Of the agencies located within the Ministerio del Tabajo

Salubridad y Prevision Social, and the Caja de Seguro y Ahorro Obrero enjoyed the greatest autonomy.

Department of Health (Dirección General de Sanidad).—Bolivia is politically divided into nine departments, which are subdivided into provinces, which, in turn, are further broken down into cantones. The Department of Health, however, administered its services through 12 sanitary districts, headquarters of which were most often located in department capitals. Those in charge of sanitary districts directed public health programs through the capitals of the provinces under their jurisdiction. Those in charge of health programs in the provinces had jurisdiction, in turn, over health establishments in the cantones.

During 1946, the Department of Health and its related services, including hospitals, employed approximately 2,000 persons on a full- or part-time basis. This figure did not include the personnel of the various health missions sent into the country by the United States, the Rockefeller Foundation, and religious groups.

The Department of Health encompassed several Divisions—Vital Statistics, Records, Technical Services, Nursing Services, Biologic Products, Ophthalmology, Maternal Hygiene, Sanitary Engineering, and Research. At the time of this survey, however, the greatest proof of these Divisions' existence was an organization chart.

The Director General of Public Health was deeply interested in industrial hygiene, but the limited funds and organization at his disposal are not conducive to the furthering of an industrial hygiene and safety program.

Department of Labor (Inspección General de Trabajo).—The Department of Labor included Divisions of Labor Conciliation and Factory Inspection. The latter function was administered through four geographic zones. The number of factory inspectors employed, however, was far too small even to begin to cope with factory problems. It is doubtful whether the staff could visit the mines and factories for which they were responsible once a year. The Division of Factory Inspection, like the Department of Health, has left the field of industrial health completely untouched, although it has concerned itself somewhat with the prevention of accidents.

Workmen's Compensation (Caja de Seguro y Ahorro Obrero).—The government agency which has done most in the field of industrial hygiene and safety, with the exception of the SCISP (a temporary agency), is Workmen's Compensation. This agency handles the national workmen's compensation fund and workers' savings. The agency has a director, a general manager, and Divisions of Safety, Administration, Engineering, and Economic Studies.

In an effort to protect its funds, the Agency has attempted to inaugurate industrial hygiene and safety practices in those industries with which it dealt. Under the jurisdiction of the Medical Division,

a small group of workers concerned itself with a program for the prevention and control of occupational accidents and diseases. This section was staffed by a safety engineer on loan from the International Labour Office and a physician who had been sent to the United States to study industrial medicine. This small staff had instituted a program of preplacement examinations for workers, including chest X-rays to determine their fitness for employment in the dusty trades. The clinical examinations given were quite sketchy, however, and it was questionable whether they would yield the results desired.

Department of Mines (Dirección General de Minas y Petróleos).—The Department of Mines took no active part in insuring mine safety and hygiene. It concerned itself primarily with economic studies of mine resources in Bolivia.

Inter-American Cooperative Public Health Service (Servicio Cooperativo Inter-Americano de Salud Pública) (SCISP).—The only industrial hygiene and safety work of any note was that conducted by the Labor Section of the SCISP. Some of SCISP's activities have been mentioned in an earlier section of this report. In addition, SCISP was attempting to strengthen the Division of Factory Inspection within the Department of Labor.

Although SCISP was set up as a temporary organization, its activities provide an excellent foundation for a long-range permanent industrial hygiene and safety program.

This study of official agencies which might have been concerned with industrial hygiene revealed quite clearly that little was being done which might serve as a nucleus for an industrial hygiene program. Nevertheless, if a permanent program is to be established, there will be a need to coordinate all the scattered activities which are in existence, so that all resources may be used to advantage.

Peru

Although only the Ministry of Health and Social Welfare is authorized to conduct industrial hygiene activities, other official and nonofficial agencies in Peru have a stake in the problem. The official agencies covered in the present inquiry were the Department of Labor in the Ministry of Justice and Labor, the Bureau of Mines and Petroleum in the Ministry of Development and Public Works, the Department of Health in the Ministry of Public Health and Social Welfare and the Inter-American Cooperative Health Service.

Bureau of Mines and Petroleum.—The Bureau of Mines and Petroleum is charged with the prevention of accidents in mining establishments. Although the law under which the Bureau functions states that mining establishments must hire security inspectors and regional technical delegates to make inspections and recommendations, the Bureau has one chief mine inspector and three assistants to administer the

program in the entire country. Obviously, this is an inadequate staff. Its impotence is reflected in the fact that many safety hazards were observed during this survey.

Department of Labor.—This Department maintains a division of factory inspection which concerns itself primarily with safety hazards, employment of women and minors, and workhours and wages. The factory inspection division maintains 21 regional offices. The Department of Labor also handles compensation claims for occupational diseases and accidents. Neither this Department nor the Bureau of Mines concerns itself with industrial hygiene.

Department of Health.—The Department of Health in the Ministry of Health and Social Welfare is a centrally organized activity. The author observed the work of its various divisions, particularly the work of such divisions as sanitary engineering, venereal disease control, malaria control, vital statistics, tuberculosis control, nutrition, and the National Institute of Hygiene, which operates the laboratories of the Health Department. All of these divisions were operating with limited funds and personnel, but evidenced a deep interest in the possible integration of industrial hygiene with their work. As pointed out in the earlier sections of this report, general public health problems in the industries of Peru are so great that it will be essential to integrate industrial hygiene work with the other public health activities if a total health program is to reach all workers. This phase of the program will be discussed in the recommendations which will follow.

Inter-American Cooperative Public Health Service.—Under the terms of the contract between the Institute of Inter-American Affairs and the Ministry of Health and Social Welfare setting up the Servicio Cooperativo Inter-Americano de Salud Publica, the work of the Servicio is limited to certain areas of the nation. The mining sections in the Central Andes and in the northern and southern sections of the country have not yet been touched by this cooperative program. The Servicio is badly needed in these areas in which the largest part of the nation's population lives and works. It is hoped that the cooperative service will play an important role in the establishment and development of an industrial hygiene program in Peru.

Chile

The official agencies covered in the study were the Ministry of Health, Social Insurance and Social Assistance, including the Department of Health, the Workers' Compulsory Insurance Fund, the School of Public Health, and the Inter-American Cooperative Public Health Works; the Industrial Hygiene Section of the Department of Inspection in the General Labor Office of the Ministry of Labor; the Bureau of Labor Accidents; the Department of Mines and Petroleum in the Ministry of Economies and Commerce; and the Development Corporation.

Department of Health.—The Department of Health in the Ministry of Health, Social Insurance and Social Assistance functions as a centrally organized activity. The divisions in this Department have been created and developed in a haphazard fashion, which has often led to overlapping services. The author reviewed the work of these Divisions, paying particular attention to those which might be involved in a complete health program for industrial workers. Among these Divisions were Industrial Hygiene, Sanitary Engineering, Tuberculosis Control, Venereal Disease Control, Health Education and Vital Statistics. For the purpose of the present discussion, only the work of the Division of Industrial Hygiene will be considered in detail. It is sufficient to report that the heads of other Divisions were deeply interested in coordinating their work with any industrial hygiene program which might be developed. The importance for such a coordinated approach in a country such as Chile, where so much public health work needs to be done, has already been discussed and will be treated again in the recommendations which follow.

The Division of Industrial Hygiene in the Department of Health was organized in 1932, but until a few years ago, it was staffed by untrained people. During the early period, the Division devoted itself to inspection work in Santiago and placed its main emphasis on general sanitation. A physician, an engineer, and chemist were trained in the United States during 1944-45, but since 1946 only the physician has been engaged in industrial hygiene work. At the present time, the Division consists of one physician, one engineer, one secretary, and one stenographer. The physician and engineer have responsibilities other than their industrial hygiene activities in the Department of Health; their salaries are derived from several sources. In addition to his duties in the Division, the physician works in a hospital, is responsible for the industrial hygiene course at the School of Public Health, and has been used by the Labor Department as an impartial arbiter in medico-legal problems in connection with compensation claims; the engineer is employed in one of Sanitago's sanitary districts. The present budget for the Industrial Hygiene Division is pitifully small; it provides the part-time salaries of the personnel listed, and a pittance for travel. No funds are allowed for equipment or supplies.

With the aid of funds acquired from the Institute of Inter-American Affairs, the Industrial Hygiene Division has begun to establish a laboratory at the School of Public Health and is also acquiring chemical reagents needed for its work. Some equipment needed for field studies has also been obtained. The Division's library is not very extensive. It contains little besides books and reprints which are the personal property of the physician. At the Department of Health the Division has two offices and no laboratory. Better facilities for the Division are located in the School of Public Health where there is an office for the physician and engineer, and two laboratories.

After unsuccessful attempts to organize a minimum staff for the Industrial Hygiene Division, the physician has confined his activities to the conduct of preliminary surveys in Chile's important industries. These have been done with the assistance of other divisions in the Health Department, the Department of Mines and Petroleum, the Industrial Hygiene Section in the Labor Department, and other agencies. A report of these surveys has been presented to the Department of Health. Other activities of the Division have been of an epidemiological nature, such as a study of anthrax, an investigation of hazards in the hemp industry, and animal studies on carbon monoxide poisoning. More recently, the Industrial Hygiene Division surveyed some 400 industries in Sanitary District 1 of Santiago. This survey was preliminary in character and served only to define the industrial hygiene problem. In order to assist these industries with the solution of their problems, it will be necessary to make detailed studies of the health of the workers and their working environments. This can only be done through the activities of a complete industrial hygiene program.

The Industrial Hygiene Division of the Department of Health is responsible for supervising all matters relating to industrial welfare, investigating occupational diseases, and developing methods for their control. Because of a lack of funds and limited personnel, these responsibilities have not been fulfilled. The Division's outstanding accomplishment has been the definition of the industrial hygiene problem in Chile's industries through the conduct of preliminary surveys of health hazards. Since this is the first step which must be taken when a complete industrial hygiene program is established, the work which has been done so far is a step in the right direction.

Workers' Compulsory Insurance Fund.—No attempt will be made to discuss the work of the Workers' Compulsory Insurance Fund in this report since a comprehensive article on the subject, entitled "Social Security in Chile," by Wilbur J. Cohen was published in the May 1947 issue of the Social Security Bulletin. The author wishes to point out that this agency has some responsibility for industrial hygiene through the work of its Institute of Labor Medicine and its activities under the Preventive Medicine Law.

Unquestionably, the social security laws of Chile, taken as a unit, constitute one of the most important pieces of social legislation enacted anywhere in the world. Chilean workers who are suffering from some form of disability are assured of adequate medical and hospital care and relief from some of their financial burdens. In this respect, workers in Chile are far better off than workers almost anywhere else in the world.

Chilean industries place great emphasis on a worker's welfare. Some of the larger plants offer facilities for recreation and education, and provide nurseries and counseling on personal problems through social service divisions.

It is unfortunate that Chile's attitude toward compensating a worker for disability is not matched by a similar attitude toward the prevention of disability. With but one or two outstanding exceptions, this study shows that industry pays no attention to the prevention and control of accidents, occupational diseases, and illnesses. Apparently, management believes that it has done its duty when it has paid taxes for social security and welfare benefits. There is apparently little realization on the part of management that it is far cheaper in the long run to prevent a disability than to pay for it; workers do not seem to recognize that no amount of money will give them back their health or lost limbs. An effective and vigorously prosecuted industrial hygiene program is needed to prove to industry and labor that prevention is cheaper than compensation in the long run.

School of Public Health.—The School of Public Health, created in 1943, is supported by the Department of Health, the University of Chile, and the Rockefeller Foundation. Its erection was a project of the Inter-American Cooperative Public Health Works. Since its establishment, the School has presented a course in industrial hygiene and built up its facilities in this field. Through its many contacts the School has gained the confidence and respect of industry which looks to it for guidance and leadership on industrial hygiene matters.

The School of Public Health is the only agency in Chile which has the trained personnel, equipment and laboratory facilities for the conduct of an effective industrial hygiene program. While enjoying close working relationships with the National Department of Health and other governmental agencies which administer social welfare laws, the School is able to carry on its work untrammelled by political considerations. For these reasons, the School is in an excellent position to render impartial fact-finding services in industrial hygiene to both industry and government.

Inter-American Cooperative Public Health Works.—Since early 1943, the Ministry of Health, Social Insurance and Social Assistance and the Institute of Inter-American Affairs have been operating a cooperative public health program. The agreement between these two agencies is similar to agreements which the Institute of Inter-American Affairs has made with health ministries in other Latin American countries. No attempt will be made to discuss the excellent work which this program is accomplishing in the field of public health. The sanitation projects, health centers, and hospitals built by the Inter-American Cooperative Public Health Works should be mentioned, however. The author desires to point out that the Inter-American Cooperative Public Health Works is in an excellent position to assume an active role in any industrial hygiene work which may develop in Chile.

Labor Department.—The Department of Labor has responsibility in the field of industrial hygiene, and in the administration of the work-

men's compensation laws. The Industrial Hygiene Section in the Department of Inspection is composed of three physicians and three engineers. The latter operate on a regional basis—one out of Santiago, one out of Antofagasta, and the third out of Concepcion. This staff, however, is not specifically trained in industrial hygiene and has neither equipment nor laboratory facilities for evaluating health hazards and devising methods of control. The services of the industrial hygiene physician in the Department of Health have been used to diagnose questionable occupational disease claims.

Bureau of Labor Accidents.—The Bureau of Labor Accidents is a government-controlled insurance fund which insures workers against accidents and occupational diseases in Chile. The Bureau has a staff of eight inspectors whose duty it is to study and eliminate hazards. None of these inspectors has been trained. The Bureau maintains a Traumatological Institute, which treats injured workers and provides them with some vocational training after their treatment is completed. An educational program, designed to prevent accidents in industry, is also conducted by the Bureau.

Department of Mines and Petroleum.—The Department of Mines and Petroleum functions primarily as a technical and scientific agency and deals with matters related to mining and allied industries. This Department is responsible for administering the mining code and other legislation which regulates working conditions in mines. The few mine inspectors employed by the agency do not have the technical knowledge, the equipment, or the facilities for conducting an effective health program in the mining industry.

Development Corporation.—The Development Corporation of Chile is a government-financed organization established in 1939 to spur Chile's industrial and economic development. The Corporation functions by means of loans, capital investments, and direct operations. As a result of the activities of the Corporation, many new manufacturing industries have been developed and others have received financial support for expansion and modernization. The Corporation is particularly interested in developing heavy industry in Chile and has recently assisted with the development of power resources and the construction of a steel mill.

The Development Corporation has an unusual opportunity to establish progressive and modern industrial hygiene programs in those industries which it operates itself and to foster such programs in those industries which it is assisting financially.

Overlapping of Functions.—Cohen, in his recent article on social security in Chile, points out that some 40 separate agencies administer social insurance laws. Although the majority of the country's insured wage earners are beneficiaries of only five of these agencies, there is bound to be some duplication of effort even among these five. This

duplication of effort stems largely from the fact that there is an overlapping of authority in the basic laws under which the agencies function. This is especially true with regard to industrial hygiene activities. For example, the Ministry of Labor has the right to maintain an Industrial Hygiene Section within its Department of Labor while the Ministry of Health has authorization for a Department of Industrial Hygiene in the National Department of Health. The Bureau of Labor Accidents is empowered to carry on an advisory industrial hygiene and safety program among its insured. The Workers' Compulsory Insurance Fund, through its Institute of Labor Medicine, also functions in this field. The Department of Mines and Petroleum has responsibility for the health and safety of workers in mining and allied industries. And, finally, even the municipalities have broad authority in many phases of industrial hygiene. In order to avoid some of the duplication of effort present in the limited programs now in existence in these agencies in Chile, there is obvious need for leadership to effect coordination. One of the recommendations will discuss how this may be accomplished.

NONOFFICIAL AGENCIES

Important resources in the development of public health programs are the nonofficial voluntary agencies. Industrial hygiene authorities have stated that the major needs fulfilled by an industrial health and safety program are the prevention of disability in industry through proper control of the working environment, medical and surgical care to effect prompt restoration of health and earning capacity following disability, and promotion of good general health among workers. It is obvious that voluntary organizations can help immeasurably with the fulfillment of these needs.

For example, in the United States, the Council on Industrial Health of the American Medical Association has suggested activities and standards for physicians who work in industry, as well as for private practitioners. Although it is true that the official industrial hygiene agency can serve as a spearhead for bringing health services to workers, it is also true that most workers turn to their own physicians when they are in need of medical attention. For this reason, the work done by the Council on Industrial Health has been of great value. Similarly, industrial hygiene in the United States has drawn heavily upon the assistance and support of agencies sponsored by management groups, local medical societies, universities, and, in recent years, progressive labor unions.

Bolivia

In Bolivia, no activities of the type described above were in progress. There are almost 600 physicians in Bolivia, nearly half of them in

La Paz. Some of these physicians are employed full time by industrial concerns, but few of them have a working knowledge of the occupational diseases or of the preventive aspects of medical practice. During this survey, the medical society was in process of reorganization, and it was urged that a committee on industrial health and safety be established.

Management organizations, such as the National Chamber of Commerce and local chambers of commerce, were also inactive in the field of industrial hygiene and safety. The same was true of labor unions which were intensively preoccupied with bargaining for higher wages and shorter hours. Internal regulations, in effect in most industries, were not used to improve health and working conditions to any extent.

Medical, mining, and engineering schools took no active part in training students for work in industrial hygiene and safety.

Peru

As in Bolivia, the picture of nonofficial industrial hygiene activity in Peru is an impoverished one. Like their Bolivian colleagues, few of the 1,500 physicians in Peru are familiar with occupational and preventive medicine.

In Peru there is a national Chamber of Commerce and also a National Manufacturing Association. Neither of these two management groups has been active in the field of industrial hygiene. Peru also has a national mining association but until now, by way of an industrial hygiene program, the organization has sponsored a survey by a Canadian mining engineer and has vigorously fought the recently enacted industrial hygiene law.

Labor, too, has not shown any active interest in the field of industrial hygiene, except in isolated instances when labor unions demanded investigations of adverse working conditions.

Medical and engineering schools have taken no active part in training students for work in industrial hygiene.

Potentialities are great for a coordinated official-nonofficial attack on the various industrial hygiene problems of Peru, and much good would redound from such a concerted effort.

Chile

In Chile, too, there is a dearth of activity on the part of nonofficial agencies which should take an interest in industrial hygiene. Typical of the existing apathy, the medical profession is poorly informed on occupational diseases. Industrial health problems are slighted by manufacturers' associations and organized labor alike. The National Manufacturing Society of Chile and the National Mining Society, however, are definitely interested in industrial hygiene but have not yet found a way to turn their interest into action.

A National Safety Council, which is primarily interested in acci-

dent prevention both on and off the job, has been organized in Chile. The Society issues a magazine, which has published on occasion information relating to industrial hygiene and safety, but the organization has done little more in the realm of health and safety education.

Organized labor has not shown any particular interest in industrial hygiene, probably because it has been too busy fighting for concessions such as higher wages and seniority rights. In isolated instances, labor unions have demanded investigations of adverse working conditions but because they lack an understanding of industrial hygiene and its implications, they have accepted slightly increased wages for those working in hazardous occupations as a satisfactory solution. No demands have been made by labor unions for improvement of working conditions and elimination of unhealthful situations.

The University of Chile, through its recently established School of Public Health, is doing an excellent job of training physicians and other public health workers in industrial hygiene practice. The engineering school has taken no active part in training engineering students for this important activity.

Obviously, Chile has the resources, among its official and nonofficial agencies, for a coordinated attack on its many and urgent industrial hygiene problems. What is required is the active leadership of a well staffed and supported industrial hygiene division which can coordinate all these potential resources into an integrated program.

VI. Summary

The industrial hygiene scene in Bolivia, Peru, and Chile is fundamentally characterized by duplication of effort and inadequate programming in official quarters and apathy in nonofficial groups. There are a few overtones here and there of a real interest in industrial hygiene work, but lack of funds, personnel, and knowledge of the modus operandi hinders development of this interest beyond an embryonic stage.

Although the coordination of industrial hygiene activities with general health programs is axiomatic anywhere, it is particularly urgent in these South American countries because of the serious prevalence of disease. Passive agencies must be awakened to the import of the problem while aware groups are galvanized into effective action. There is need to evoke the maximum potential that each agency can contribute and to arrange these activities in an orderly pattern which avoids overlapping of function and enables the highest degree of efficacy.

Based upon pertinent observations in each country, the following recommendations were made to assist Bolivia, Peru, and Chile in the development of sound, effective industrial hygiene programs. Such a sturdy foundation of industrial health is mandatory if these nations are to realize their full industrial potentialities.

VII. Recommendations

These recommendations were offered in an attempt to help those officials who are interested in industrial hygiene plan and establish comprehensive and progressive programs in Bolivia, Peru, and Chile.

Although the suggested organizational structure varied in the three countries, the recommendation common to all was that a division of industrial hygiene be established, or implemented as in the case of Chile. This unit would then act as the keystone in the development of industrial hygiene programs. Based on the premise that corrective measures for the protection of the health of industrial workers are put into effect by private effort and by use of private funds, the unit's most important task would be to show industry how to solve its own problems.

The types of service which the unit would render to industry to fulfill its broad responsibilities are: (1) Evaluating industrial working environments and recommending steps to be taken to correct conditions found to be detrimental to health; (2) Advising management and medical supervisors concerning the relative toxicity of materials or processes, giving special attention to new materials prior to their introduction into industry; (3) Offering consultant services to medical supervisors and private physicians regarding illnesses affecting workers; (4) Providing necessary clinical and physical laboratory services; (5) Assisting management to develop, maintain, and analyze absenteeism records and health education programs; and (6) Offering technical guidance and advice on adult health and health education programs for workers.

The unit would also be responsible for formulating standards for safe practices and reasonable rules and regulations for the prevention and control of occupational diseases. These standards and regulations would be used in making recommendations to industry regarding the correction of conditions inimical to health. Legal regulations, of course, should be resorted to only when friendly persuasive measures have failed, since the latter is often more successful.

Close liaison would be maintained with other agencies to avoid duplication of effort and to encourage correlated, supplemental activities.

The unit would likewise stimulate and coordinate the work of related voluntary agencies.

Responsibility for collecting and analyzing occupational disease reports would also rest with this unit. To ensure completeness of reports, the unit would have to educate physicians and industrial management to the importance of occupational disease reporting and to maintain close contact with them by investigating all cases reported promptly.

Whenever called upon, the unit would render impartial advice to the Workmen's Compensation Agency in the settling of claims.

Another important function of the unit would be to assume the leadership in encouraging large industries to sponsor complete industrial hygiene programs of their own. These programs should include general health activities and draw upon all the health resources available in the community. This expansion of industrial health programs into the broader field of adult health has been encouraged in the United States by both Federal and State industrial hygiene agencies. Progressive industrial management has been quick to realize that a worker's productivity is directly influenced by his general health.

Some of the illiteracy and negligence obstacles may be surmounted by the formation of labor-management committees to educate and train the workers. This device gives the workers a sense of participation and was used with great success in both the United States and Great Britain during the war.

One of the first educational jobs that would confront the unit, however, is the development of courses of instruction for physicians, engineers, and nurses who wish to work in the field of industrial health. This project should be undertaken with the cooperation of universities and professional societies.

Sufficient funds should be granted the unit to purchase the specialized equipment needed for field and laboratory work and to set up and stock a library. To ensure the employment of properly qualified individuals, a description of the positions entailed in the conduct of an industrial hygiene program and of the requisite qualifications was prepared for submission to the appropriate agencies.

Manned by a qualified staff and equipped with adequate facilities, the unit would be in a position to chart an ambitious course, utilizing all existing knowledge and techniques in the promotion and preservation of industrial health.

The following individual recommendations are peculiar to the respective situations in Bolivia, Peru, and Chile and are based upon the special needs, administrative channels, and operating facilities observed in those countries.

Bolivia

It is recommended that the unit of industrial hygiene, propounded in the preceding section, be established as a Division of Industrial

Health and Safety within the new Ministry of Labor and Social Welfare. The Division should have complete autonomy, reporting directly to the Minister or a subminister. It is further recommended that the basic industrial health and safety law, drafted to meet Bolivia's particular needs, be adopted by the Bolivian Congress as speedily as possible.

In addition to miners and industrial workers, the Division's activities should embrace the uncounted thousands engaged in agricultural pursuits.

The Division's staff should include at least one physician, industrial hygiene engineer, safety engineer, and clerk, all members functioning as a team. The duties and functions of the Division have been discussed in the foregoing description of the industrial hygiene unit's responsibilities.

It is also recommended that the Minister of Labor and Social Welfare appoint an Advisory Committee to the Division of Industrial Health and Safety. The Committee should be made up of representatives of the Ministry of Hygiene and Health, the Workmen's Compensation Agency, the Bolivian Medical Society, industrial management and organized labor. The function of the Committee would be to advise the Division on matters of policy and operation.

It is recommended, too, that the occupational disease compensation law now in effect in Bolivia be revised. Diseases which are not occupational in origin, such as tuberculosis and nephritis, should not be compensable. Provision for compensation for partial disability from silicosis should be eliminated. Compensation funds saved by these changes should be used to support a vigorous program of prevention and health education for industrial workers.

Legislation to prohibit child labor should be adopted by the Bolivian Congress as speedily as possible. At the same time, educational facilities should be improved so that the growing generation will be able to take advantage of a health education program.

To furnish experienced leadership to the proposed Division of Industrial Health and Safety in the launching of its program, it is recommended that a consultant in industrial hygiene and safety be attached to the SCISP for several years after the scheduled termination of the labor program.

Peru

On March 12, 1947, a law was enacted creating a Department of Industrial Hygiene in the Ministry of Public Health and Social Welfare, whose function is the prevention of professional diseases—the pneumoconioses, in particular. It is recommended that the activities of this Department be administered under the direction of the (SCISP), Servicio Cooperativo Inter-Americano de Salud Pública. Directed by trained and well-qualified personnel, the Servicio has demonstrated its

bility and usefulness in administering a public health program in Peru.

The services of a physician and a chemist from the United States should be added to this program as soon as possible to supplement the work of the engineer already assigned by the Institute of Inter-American Affairs. Necessary field and laboratory equipment should be obtained immediately to permit prompt operation.

The industrial hygiene program should start as soon as is practicable in the region of Cerro de Pasco, with headquarters in the town of Cerro de Pasco, the center of the most important mining area in the Central Andes. This field office should be equipped for the conduct of physical examinations, as required by the new law, and for the activities of an engineer.

Field centers should later be established in La Oroya, Morococha, and Lima. Each field office should be staffed with a physician trained in silicosis techniques, an X-ray technician, an engineer, and a clerk. The necessary apparatus for conducting physical examinations, including X-rays of the chest, and field and laboratory apparatus for the engineer, will also be needed. The Lima office should have portable X-ray and other equipment for conducting physical examinations in the Southern mining area.

The Department's chemical laboratory should be located in Lima.

Personnel, both medical and engineering, should be selected as speedily as possible and sent to the United States for training. The physician now studying at Harvard should spend at least 3 months studying silicosis at the Saranac Laboratory for the Study of Tuberculosis before he returns to Peru. In order to initiate the program of physical examinations at once, a physician should be employed immediately. (It is understood that a Peruvian physician will be immediately assigned to this program from the Servicio Cooperativo Inter-Americano de Salud Pública and will receive his training in Peru. A Peruvian chemical engineer has already been selected and engaged to work under the engineer now assigned to the program by the Institute of Inter-American Affairs.)

It is also recommended that the President of the Republic of Peru appoint an advisory committee to the Department of Industrial Hygiene. The committee should be made up of representatives of the Ministry of Justice and Labor, the Ministry of Development and Public Works, the Ministry of Public Health and Social Welfare, the Peruvian medical society, industrial management, and organized labor. The committee should advise the Department on matters of policy and operation.

As provided by law, the scope of the Department's activities should be extended at the end of 2 years of operation to include all the industries of Peru. Services should also be available to the more than 1,000,000 agricultural workers.

In order to assure the new Department of Industrial Hygiene com-

petent guidance during the period immediately following its organiz
tion, the program should be administered by the Servicio Cooperati
Inter-Americano de Salud Pública for at least the next 2 years. Ste
should be taken to include an industrial hygiene program among t
cooperative activities carried on by the Institute of Inter-Americ
Affairs and the Ministry of Public Health and Social Welfare of Per

Chile

Since the School of Public Health possesses superior operating f
cilities and enjoys political freedom and public confidence, it is reco
mended that an Institute of Industrial Hygiene be created within th
State institution.

Approximately 1,250,000 pesos a year will be needed to carry on
minimum program in industrial hygiene. This sum might well
obtained from those sources which would benefit most from such a pr
gram, namely, labor, industry, and government.

As a minimal staff, the Institute should have a physician directo
an engineer, a chemist, a clerk and a laboratory assistant. For the fir
several years, the program should be based in Santiago. It is reco
mended, however, that at a later date branch offices be established
Antofagasta and Concepcion to serve the northern and southern zones

There is now in Chile a nucleus of personnel trained for the condu
of industrial hygiene activities. In order to interest these people
joining the Institute of Industrial Hygiene, it is essential that positio
in the Institute be set up as full-time, permanent, well-paying posts.

As in the case of Bolivia and Peru, it is recommended that the Pres
dent of Chile appoint an advisory committee to the Institute of Indu
trial Hygiene, composed of representative members.

Consideration should be given to strengthening the Preventive Med
cine Law of Chile so that annual physical examinations may be bett
employed in the interest of improving workers' health. This law shoul
also be revised so that the preemployment examinations now given ca
be more fully utilized as placement guides.

Because of weaknesses in the workmen's compensation legislatio
it is recommended that a Presidential committee be appointed to stud
the law and suggest corrective changes in its content and administratio

Finally, in order to coordinate the activities of all the participant
in the proposed program, it is recommended that an experienced tech
nician from the United States be employed for a period of 1 to 2 years

APPENDIX I — INDUSTRIAL HYGIENE SURVEY — GENERAL DATA

Date

Name of establishment — Owner

Department — Province — Number of employees

Official interviewed — Title — Male — Female

Products or service — Total

Medical provisions

Hospital: Company / Contract / None

First-aid room: Yes / No

First-aid kit: Yes / No

Trained first-aid worker: Yes / No

Physician: Full time / Part time / On call

Nurse: Full time / Part time / None

Dentist: Full time / Part time / On call / None

Preplacement examination: Yes — No

Periodic examination: Yes — No

Health and safety committee: Yes — No

Industrial hygiene responsibility:

Average wages:

Labor turnover:

Number shifts worked:

Schools: Type

Benefits and records

Sickness benefits:
- Management
- Union
- Insur. Co.
- None

Extent of benefits:
- Sickness
- Accident
- Hospital

Disability records:
- Occupational
- Nonoccup.
- Accident

Feeding facilities:
- At workplace

Community:
- Type of stores

How operated:

Safety provisions

Safety director: Full time / Part time / None

Shop committee: Yes / No

Insurance company service: Yes — No

Sanitation

Water supply:
- Public
- Private
- Approved

Drinking facilities:
- Fountain
- Individual cup
- Common cup
- Other

Lockers:
- Yes
- No

Sewage disposal:
- Public
- Private (type)

Washing facilities:
- Basin
- Shower
- Water: Hot / Cold
- Towel: Com. / Ind.
- Soap

Toilet facilities:
- Flush
- Pit privy
- Other

Housing conditions

General:

Number rooms — Water

Number occupants — Sewage

Sanitary facilities — Toilets

Garbage

INDUSTRIAL HYGIENE SURVEY—EXPOSURE DATA

Date _____

_____

Name of establishment: _____

Raw materials: _____

Products: _____

Processes: _____

Exposures: Estimate number exposed _____

Dusts: _____

Type: _____

Control measures: _____

_____

Fumes and gases: _____

Type: _____

Control measures: _____

_____

Special poisons: _____

Type: _____

Control measures: _____

_____

Temperature extremes: _____

Control measures: _____

_____

Ventilation: _____

Type: _____

Adequacy: _____

_____

Other notes: _____

_____

_____

_____

_____

Appendix II

ORGANIZATION OF THE DEPARTMENT OF INDUSTRIAL HYGIENE IN THE MINISTRY OF PUBLIC HEALTH

LAW NO. 10833

The President of the Republic:
Whereas:
Congress has enacted the following Law:
Congress of the Peruvian Republic:
Has enacted the following Law:

Article 1.—The Department of Industrial Hygiene in the Ministry of Public Health and Social Welfare shall begin work regarding prevention and attendance of professional diseases, especially the pneumoconioses.

Article 2.—Work stated in Article 1 shall include, besides work specified by the Executive Power in later dispositions and regulations, the following:

(*a*) Clinical and radiographic examination of candidates for mining work and the same examination, periodically done, on workmen performing such work;

(*b*) Medical examinations, requested by the Pneumoconiosis Expert Board;

(*c*) Medical control of individuals suffering from pneumoconiosis or other professional diseases, who continue working;

(*d*) Periodic inspection of mines and plants of the industry itself for dust control. This work shall include the sampling and analysis of dusts in suspension, smoke, gases, acids and other noxious substances;

(*e*) Planning and application of ventilating systems and methods for the mines and working places;

(*f*) Investigations regarding suitability of installation of apparatus and dust removal equipment and use of given types of protective masks;

(*g*) Investigations regarding suitability of establishing plants for administration of aluminum powder with preventive and welfare pur-

poses; and medical control of healthy or ailing individuals, subjected to this process in plants to be established as a result of such investigations or by private initiative of companies;

(*h*) Educational work among the administrative and labor staff of mining companies with purpose of demonstrating usefulness of preventive measures and insuring cooperation to be given for fulfillment thereof; and,

(*i*) Incorporation of all measures connected with this problem in future.

Article 3.—The Department of Industrial Hygiene shall gradually extend its action to all mining centers of the country, but shall begin operations in the region including the Departments of Lima, Ica, Junin, Pasco, Huanuco, and Huancavelica.

To duly fulfill its mission and after the necessary studies, it shall establish a Central Office and Departmental Offices in principal mining regions, said offices to include administrative sections and medical and engineering laboratories, as well as portable equipment, which may be necessary.

Article 4.—The operation of the Department of Industrial Hygiene, in connection with the mining industry and allied industries, shall be maintained by those companies occupying over 30 laborers, by a contribution of 1.8 percent on the total amount of payrolls.

The designation "mining company" is understood to include individual or collective persons performing work for making use of any mineral substance and soils, rocks, clays, sands, gravels, and cements, as well as all industrial processes related to the preparation and use of such substances.

There are included in the computation of the tax salaries of all employed in those industries, under the direct dependency of said individual or collective persons or of contractors and middlemen, without any exception whatsoever.

Article 5.—The contribution established in Article 4 shall begin to govern within 30 days of the promulgation of the present law, in the Departments of Lima, Ica, Junin, Pasco, Huanuco, and Huancavelica. The same contribution shall be applied, successively and with approval of the Executive Power, to other districts, when the organization of the Department of Industrial Hygiene extends thereto.

Article 6.—Companies may not deduct, directly or indirectly, the amount of the contribution created by this law, from the salaries or other remunerations paid to their employees.

Article 7.—A Board of Vigilance and Economic Control, formed by representatives of the Executive Power and of the industries contributing to the support thereof, the number whereof shall be determined by the Government, shall control the economic progress of the Department of Industrial Hygiene and the investment of its income for the purposes specified in the present law.

Article 8.—After a period of two years, to be counted from the date on which the Department of Industrial Hygiene begins its duties, the Government shall make up another taxation plan, based on the degree of danger of the work in each mining enterprise and the number and source of the cases of professional disease.

The National Bureau of Social Insurance shall proceed to effect the necessary mathematical calculations and within the maximum period of two years, from date of promulgation of the present law, shall establish an insurance for professional diseases, to include the granting of an income to ailing individuals, with partial or total disability, temporary or permanent, which may have been established by the Pneumoconiosis Board of Experts. Said insurance shall include nursing benefits available in hospitals and other dependencies of the National Bureau of Social Insurance.

In the making up of the new taxation plan and establishment of the insurance, referred to in this Article, the information resulting from the studies performed by the Department of Industrial Hygiene shall be used.

Article 9.—The Minister of Public Health and Social Welfare shall make up, within a maximum period of 60 days from the date of promulgation of this law, the necessary drafts for the organization and regulation of the services created thereby, the technical training of its personnel, and those necessary for the coordination of the work effected by other Government Departments.

Article 10.—Laws and dispositions insofar as opposed to the present law are hereby repealed.

Let this be transmitted to the Executive Power for promulgation.

Congress House, in Lima at ten days of the month of March, nineteen forty-seven.

(Sgd.)

Jose Galvez, *President of the Chamber of Senators.*
Pedro E. Muniz, *President of the Chamber of Deputies.*
L. F. Ganoza, *Senator Secretary.*
A. Haya de la Torre, *Deputy Secretary.*

Therefore: I order this to be published and complied with.

Given in Government House in Lima, at twelve days of the month of March, nineteen forty-seven.

(Sgd.)

J. L. Bustamante.
Alberto Hortado.

Appendix III

SUGGESTED RULES AND REGULATIONS FOR THE PREVENTION AND CONTROL OF OCCUPATIONAL DISEASES AND A DISCUSSION OF CURRENT PRACTICES FOR COMPLIANCE WITH SUCH RULES AND REGULATIONS

J. J. Bloomfield, *Sanitary Engineer Director, Assistant Chief, Division of Industrial Hygiene, Public Health Service*
and
Bernard D. Tebbens, *Industrial Hygiene and Safety Engineer, Institute of Inter-American Affairs*

JUNE 1947

Foreword

One of the major causes of lost time in industry is workers' ill health, some of it caused by physical conditions in the job environment. Although industrial hygienists now have the techniques to prevent almost any kind of occupational disease, unfortunately the application of this knowledge has not progressed as rapidly as it has been acquired. The problem, then, is the promotion of industrial hygiene techniques so that they reach every industry.

One effective means of disseminating and applying information on good industrial hygiene practice has been through the promulgation and administration of reasonable rules and regulations designed to set forth systematically the principles involved in such practices. Such rules and regulations, or codes, as they are sometimes called, can be of significant aid to industry in achieving safe and healthful working conditions, if they are based on scientific fact, are practical and adequate.

In our opinion, the main purpose of a code is to provide information which would enable industry to maintain the health of its workers at a high level. If a code is to accomplish this purpose, it must also be reconciled with the chief aim of industry, which is to turn out goods and services in the most efficient way possible so as to achieve maximum production at minimum cost. To accomplish all this, a code should contain not only rules and regulations for the prevention and control of occupational diseases, but also an informative discussion of the best practices in industrial hygiene, which would indicate to management and labor just how compliance with the rules may be achieved. Only the rules and regulations of such a code should be mandatory.

At the present time, there is a great deal of activity in the United States and in other countries in the development of rules and regulations, or codes, for the prevention and control of occupational diseases. For the most part, this activity has been stimulated by legislation which places certain responsibilities on industrial hygiene divisions for the promulgation and enforcement of rules and regulations. In the United States, where each State is more or less autonomous, one finds a diversity of laws and codes, not only as to content, but also as to administration. Such a state of affairs makes it extremely difficult for large industrial concerns, which operate in several States, to set a definite policy for the

maintenance of healthful conditions in their industries. For this reason, several national agencies have been attempting to develop codes of a general basic character which could be adopted by all the States in the interest of uniformity of content and administration.

The Institute of Inter-American Affairs has had a cooperative program with the government of Bolivia on health and sanitation problems. Part of this program has been concerned with working conditions among Bolivian industrial workers, and particularly the workers in the mines of that country. It is not the purpose of the present discussion to go into detail regarding the joint labor program in Bolivia with which both authors have been identified, except to indicate that one of the objectives of this labor program was the development of a practical code designed to prevent and control occupational diseases.

The rules and regulations which follow, as well as the current practices for compliance with these rules and regulations, are based, for the most part, on the material prepared for the use of the Bolivian government.

These rules and regulations have certain unique features which will become obvious to the reader, and which we feel merit serious consideration not only by management and labor, but also by governmental administrative agencies which have the responsibility for industrial hygiene work. As a matter of fact, the section dealing with current practices for compliance with the suggested rules and regulations is in itself a novel feature in codes of this type. Although the current practices discussed herein for the attainment of healthful working conditions could be presented in greater detail, we do feel that in its present brief form it contains sufficient information to be of aid to industry in attempting to comply with the rules and regulations.

It is our desire to emphasize the need for a realistic approach to this whole subject. We feel that there is a definite responsibility upon governmental agencies administering industrial hygiene to implement rules and regulations for the prevention and control of occupational diseases in a practical and impartial manner. It seems to us that before an industry is told that it should make certain provisions to control a condition suspected of being inimical to health, a complete health survey is in order. Such a health survey should involve at least two criteria in determining the safety of an operation. First, it is essential that the health of those workers exposed to a certain material or condition should be carefully inquired into. This may involve not only an examination of the worker's health record, but also an examination of the worker himself. Second, careful environmental studies should be made, which would include not only certain determinations of the atmosphere, but also a thorough sanitary survey and occupational analysis. All these put together should yield data of real value in helping to control industrial health hazards.

It is hoped that the material which follows will be given serious consideration by management, labor, and those governmental agencies responsible for industrial hygiene administration. All three groups have a large stake in the maintenance of industrial health. All that is needed to assure the success of basic rules and regulations such as those suggested in this paper is that they be administered in a spirit of cooperation with management and with labor.

SUGGESTED RULES AND REGULATIONS FOR THE PREVENTION AND CONTROL OF OCCUPATIONAL DISEASES

I. Introduction

A. *Authority*

This code has been adopted by the ..... of the ..... in the discharge of its duties under the authority granted by the .....

B. *Purpose*

The purpose of this code is to prescribe minimum requirements for the prevention and control of occupational diseases, to advance the workers' health, and to furnish information for the use of management and employees in attaining these objectives.

C. *Application*

The provisions of this code shall apply to all mines, factories, construction projects, service industries, and other places of employment. The provisions of this code are limited to the prevention and control of occupational diseases and do not abrogate existing codes, nor prevent the adoption of future codes, dealing with general sanitation of work places.

D. *Administration*

This code will be enforced by the ..... of the .....

E. *Appeal for Modification*

When strict compliance with the provisions of the code involves undue hardship, the ..... may, upon application in writing, permit modification of the requirements when other means of equivalent protection are provided. Any modification granted under

the provisions of this paragraph shall be limited to the particular case covered in the application of appeal for modification.

F. *Penalties*

Any person, firm, or corporation failing or neglecting to comply with any rule or regulation of this code shall under the powers conferred by ..... be guilty of a misdemeanor, and upon conviction shall be fined in accordance with the provisions of the above law.

G. *Unconstitutionality Clause*

Should any section, paragraph, sentence or clause, or phrase of this code be declared unconstitutional or invalid for any reason, the remainder of said code shall not be affected thereby.

H. *Repeal and Date of Effect*

All codes and parts of codes in conflict with this code are hereby repealed, and this code shall be in full force and effect immediately upon its adoption and its publication as provided by law.

I. *Definitions*

(1) A "health hazard" shall be interpreted to exist when exposure to any contaminant or condition encountered in the environment is sufficient to injure any part of the body or reduce in efficiency the normal function of any part of the body.

(2) "Ventilation" is the process of supplying or removing air by natural or mechanical means to or from any space.

(3) "General Ventilation" means that type of ventilation in which air is supplied to or removed from any area.

(4) "Natural Ventilation" means ventilation which depends upon natural air currents to provide air movement in the environmental area.

(5) "Mechanical Ventilation" means ventilation which depends upon the operation of power driven equipment to remove air from or deliver air to the desired location or area.

(6) "Local Exhaust Ventilation" means that type of ventilation in which dusts, fumes, vapors, gases, and mists are removed from the atmosphere near the sources of their generation.

(7) "Dusts" are solid particles generated by handling, crushing, grinding, rapid impact, detonation and decrepitation of organic or inorganic materials, such as rock, ore, metal, coal, wood, grain, etc. Dusts do not tend to flocculate except under electrostatic forces; they do not diffuse in air but settle under the influence of gravity.

(8) "Fumes" are solid particles generated by condensation from the gaseous state, generally after volatilization from molten metals, etc.,

and often accompanied by a chemical reaction such as oxidation. Fumes flocculate and sometimes coalesce.

(9) "Mists" are suspended liquid droplets generated by condensation from the gaseous to the liquid state or by breaking up a liquid into a dispersed state, such as by splashing, foaming, and atomizing.

(10) "Vapors" are the gaseous form of substance which are normally in the solid or liquid state and which can be changed to these states either by increasing the pressure or decreasing the temperature alone. Vapors diffuse.

(11) "Gases" are normally formless fluids which occupy the space of enclosure and which can be changed to the liquid or solid state only by the combined effect of increased pressure and decreased temperature. Gases diffuse.

(12) "Healthful and Comfortable Environment" means atmosphere having an effective temperature as near the comfort level as good industrial hygiene engineering practices will permit and never at a level at which injury to health will result. This does not apply to environments where abnormal temperature and/or humidities are encountered through the inherent nature of the process and where individual protection is given through clothing, supplied air, or other means.

(13) "Abnormal Atmospheric Pressures" means atmospheric pressures which when suddenly adjusted to normal atmospheric pressure, may produce injury to workers occupying that area.

(14) "Sanitary Condition" means physical condition of working environments such as will tend to prevent the incidence and spread of disease.

(15) "Contaminant" means an undesirable substance or material.

(16) "An Infectious Agent" is a pathogenic microorganism which is capable of producing disease by entrance into and by multiplication within the body.

(17) "Protective Equipment" is a device, a permanent installation, clothing or other means for the adequate protection of the worker against health and safety hazards.

(18) The word "shall" where used is to be understood as mandatory.

II. Rules

A. *General Provisions*

1. Records.—Every employer shall maintain adequate records of occupational diseases and other disabling illnesses which occur among his employees. In those establishments employing 50 or more persons, these records shall be tabulated and analyzed by the employer, and a statistical summary of the causes of disability shall be furnished at the end of each quarter to the ..... This quarterly statistical summary shall be prepared on forms furnished to the employer by the .....

2. Employer Responsibility.—(*a*) Every employer shall comply with the various laws pertaining to the control of industrial health hazards and shall maintain a healthful place of employment.

(*b*) Every employer shall determine the health hazards in his place of employment by means of a survey of his establishment.

(*c*) Every employer shall instruct his employees regarding the hazards to which they are exposed and the methods which have been taken for the prevention and control of such hazards. In all work places where special hazards to health exist, employers shall post a notice of such hazards in a prominent position in the work place, notifying the workers of the hazard and the means for safeguarding against it.

(*d*) Every employer shall install or provide adequate protective equipment for the prevention and control of occupational diseases and shall maintain such equipment at its highest efficiency and in a sanitary condition.

3. Employee Responsibility.—(*a*) Every employee shall use the protective equipment provided by the employer for the prevention and control of occupational diseases.

(*b*) Employees shall not abuse or mishandle in any manner equipment provided by the employer for the workers' protection against health hazards.

(*c*) Every employee shall comply with all healthful practices agreed upon between the employer and the employee organization.

4. Labor-Management Committees.—In all establishments having 50 or more employees, there shall be allowed the formation of a joint committee of equal representation from employer and employee groups for the exclusive purpose of health maintenance.

5. Notification of the Creation of New Establishments, Processes or Changes of Processes.—Every employer shall notify the ..... within 10 days of the establishment of a new enterprise, process, or change in process, and whenever practicable shall furnish the ..... with plans and specifications of such new or changed process.

B. *Environmental Conditions*

1. General.—There shall not exist in any place of employment any process, material or condition known to have an adverse effect on health unless provisions are present to maintain the occupational environment in such a state as to prevent the existence of a health hazard.

2. Maximum Allowable Concentrations for Atmospheric Contaminants.—There shall not be used any process or material which will liberate any contaminant into the atmosphere of occupied areas unless arrangements are present to prevent the contaminant from injuring any part of the body, or reducing in efficiency the normal function of any part of the body.

The maximum allowable concentration for atmospheric contaminants in occupied areas should include, but is not restricted to, the following substances and their corresponding maximum allowable concentration values:

MAXIMUM ALLOWABLE CONCENTRATIONS

Gases and Vapors

(Parts per million)

Substance	*Concentration*
Acetone	500
Acrolein	0.5
Ammonia	100
Amyl acetate	200
Aniline	5
Arsine	0.05
Benzene	35
Carbon disulfide	20
Carbon monoxide	100
Carbon tetrachloride	50
Chlorine	1
Ethyl ether	400
Formaldehyde	5
Gasoline	500
Hydrogen chloride	5
Hydrogen cyanide	10
Hydrogen fluoride	3
Hydrogen sulfide	20
Methanol	200
Naphtha (coal tar)	200
Nitrogen oxides	25
Nitroglycerine	0.5
Phosgene	1
Stibine	0.1
Sulfur dioxide	10
Trichlorethylene	100
Toluene	200

Toxic Dusts, Fumes and Mists

(Milligrams per cubic meter)

Substance	*Concentration*
Antimony	0.5
Arsenic	0.5
Cadmium	0.1
Chromic acid	0.1
Lead	0.15
Mercury	0.1
Zinc oxide	15

Mineral Dusts

(Million particles per cubic foot)

Substance	*Concentration*
Asbestos	5
Silica (more than 70%)	5
Silica (40% to 70%)	10
Silica (5% to 40%)	20
All dusts (less than 5% silica)	50

Radiation

X-rays	0.1 roentgen unit per 8 hour exposure

3. Skin Contact with Hazardous Materials.—Where the substances encountered are capable of causing any pathological change in the skin, adequate precautions shall be taken to prevent these substances from contacting the skin.

Where the substances encountered are capable of being absorbed through the skin or mucous membrane thereby producing injury to health, adequate precautions shall be taken to prevent these substances from contacting the skin and/or the mucous membrane.

4. Infectious Agents.—There shall not exist in any occupied area any processed or unprocessed material containing infectious agents unless provisions are present to prevent the infectious agents from injuring any part of the body.

5. Illumination.—The quality and quantity of illumination in any occupied area shall be adequate to permit the performance of all necessary work in a safe manner and without injury to the eyes.

6. Temperature, Humidity, and Air Movement.—Natural or mechanical ventilation shall be provided in all occupied areas to insure a healthful and, so far as feasible, a comfortable environment as regard to temperature, humidity, heat radiation and air movement.

7. Noise.—There shall not exist in any occupied area any process or operation producing noise unless provisions are present to prevent the noise from injuring any part of the body or reducing in efficiency the normal function of any part of the body.

8. Vibration.—Wherever any process or operation producing vibration is conducted in any occupied area, provisions shall be present to prevent the vibration from injuring any part of the body or reducing in efficiency the normal functions of any part of the body.

9. Pressure.—In occupied areas where the workers are subjected to abnormal atmospheric pressures, provisions shall be present to prevent injury to any part of the body of the worker upon entering, working in, or leaving that area.

10. Radiant Energy.—Wherever any type of radiant energy is emitted into an occupied area, provisions shall be present to prevent

these radiations from injuring any part of the body or reducing in efficiency the normal functions of any part of the body.

11. Ventilation.—Where excessive amounts of contaminants may be liberated into the atmosphere of occupied areas, adequate ventilation systems for their removal shall be installed, maintained in good condition, and operated efficiently at all times when work is being done.

The discharged air of a ventilating system shall not be permitted to re-enter the same or other working areas and shall not constitute a health hazard or nuisance in the community.

Plans and specifications for all ventilating systems shall be submitted to the ..... for approval prior to their installation.

12. Respiratory Protective Equipment.—When exposures to excessive amounts of atmospheric contaminants are intermittent and of brief duration, or where ventilation or other control methods are impractical, the workers shall be protected by means of respiratory protective equipment. Such equipment shall give adequate protection against the specific contaminant under the conditions encountered and shall be of a type approved by the .....

Respiratory protective equipment shall be employed only under the conditions above stated and shall not be used in lieu of other control methods of a more effective and permanent character.

13. Personal and Protective Clothing and Equipment.—Workers in operations, processes or conditions of work which unduly expose them to dampness and wet environments, excessive heat, excessive noise, hazardous radiations, and other eye hazards, skin irritants, falls, falling material and other hazards, shall be provided with proper protective clothing and other devices of a type approved by the .....
.....

14. Housekeeping.—The housekeeping in all occupied areas shall be such as to promote a healthful environment.

15. Sanitation.—The sanitation within all places of employment shall be such as to promote a healthful environment. No insanitary condition shall exist which may increase the incidence or permit the spread of disease. The handling, preparation and serving of food and drink shall be conducted in such a manner as to prevent the spread of disease.

C. *Medical Provisions*

1. Prevention and Treatment of Occupational Illnesses and Injuries.—Arrangements for facilities and services shall be present for the prevention and the prompt and early treatment of all illnesses and injuries resulting from occupational exposures.

2. Prevention and Treatment of Nonoccupational Illnesses and Injuries.—Arrangements for facilities and services shall be present for the prevention and the prompt and early treatment of all emergency nonoccupational illnesses and injuries.

3. Physical Examinations.—Every employer shall make available at no cost to a prospective worker a preplacement health examination.

Periodic health examinations shall be given to all workers requesting such examinations at no cost to the worker. In the case of workers exposed to toxic materials or hazardous conditions of work, such as those exposed to siliceous dusts, heavy metal dusts, or toxic solvents, the workers shall be examined as often as deemed necessary by the examining physician, but such examination must be given at least once a year.

In case the periodic examination shows the worker unfit for further work or for certain classes of work, thereby barring the worker's future employment, then the latter may designate a physician of his choice and request a review of the findings. If the two physicians cannot agree on the findings, then a third physician, agreed on by the two physicians, shall be selected and his findings shall be final. If the two physicians cannot agree on a third physician, then director of the .... shall make the selection.

CURRENT PRACTICES FOR COMPLIANCE WITH SUGGESTED RULES AND REGULATIONS FOR THE PREVENTION AND CONTROL OF OCCUPATIONAL DISEASES

A. General Provisions

1. *Records*

Rule.—*Every employer shall maintain adequate records of occupational diseases and other disabling illnesses which occur among his employees. In those establishments employing 50 or more persons these records shall be tabulated and analyzed by the employer, and a statistical summary of the cases of disability shall be furnished at the end of each quarter to the ..... This quarterly statistical summary shall be prepared on forms furnished to the employer by the* .....

Purpose of Rule.—In order to control and prevent disability among workers, it is necessary to determine where, when, and under what conditions absenteeism from disability is occurring.

Practices for Compliance with Rule.—Some plants will find it impracticable at the outset to collect data on absences of all durations and for all causes. As a minimum it is recommended that data on absences lasting eight consecutive calender days or longer be collected and that the reasons for absence be confined to sickness and nonindustrial injuries. However, as soon as an industry has had some experience

with regard to this type of statistics, it should give serious consideration to include absences of shorter duration and from all reasons.

In the case of industrial injuries and occupational diseases, records shall be kept on all disabilities resulting in loss of one or more work shifts.

Regardless of the length of the absence and the reason for it, information should be collected on each absence and be considered as a minimum for the following items:

(*a*) Sex.

(*b*) Date absence began.

(*c*) Date absence terminated.

(*d*) How absence was terminated (returned to work, died, resigned, separated, permanent disability, other).

(*e*) Reason for absence (sickness, nonindustrial injury, occupational disease, industrial injury, other).

(*f*) Diagnosis.

(*g*) By whom diagnosis was made.

In addition to these items, it is essential to know the number of workmen in the plant by sex, in order that rates may be calculated.

Form 1, attached, is designed to carry information on those absences which terminated during a specific month. It is eight inches long by 10.5 inches wide.

Form 2 is designed to carry information on those absences which may have begun at any time and have not as yet terminated. The absences are, therefore, those whose records are carried over into the month following the current reporting month. The size of this form is the same as Form 1.

It must be recognized that while theoretically a rate can be made specific for department, occupation, age, sex, and for whatever reason, the rate will be of questionable value if the number of workmen in the plant is small. Thus the number of workers in the group "exposed to risk" will determine principally the number of subgroups that may be profitably analyzed.

A periodic analysis of the records, as required by the above rule, will serve to call attention to conditions which are in need of correction or control. In some instances a study of the conditions in the plant causing excessive disability absenteeism will be indicated and may even call for the collection of additional data. The sick absences responding most readily to control are the minor maladies in which temperament, anxiety, lack of sense of responsibility, maladjustment, and physical ill health meet and influence each other. The routine supervision of such absences should enable the plant physician to suggest appropriate remedies. Quite often it is possible for the supervisor of the plant to be of considerable assistance in the control of sick absenteeism. He is in a position to note not only unhealthful and unsafe working condi-

tions but also early signs of disabling sickness in the worker. Very frequently a high sickness rate in a department or plant may be entirely due to a few workmen, because of some of the factors indicated above, such as temperament, maladjustment or organic disease, in need of correction.

2. *Employer Responsibility*

Acceptance of responsibility for industrial health by both management and employees is an important factor in a successful industrial hygiene program. This factor has long been effectively utilized in some countries in accident prevention and is now equally successful in the prevention of occupational and other diseases in industry.

The interests of management and labor in industrial hygiene arise from at least three sources. In the first place, there is the obligation to provide the employee with a safe and hygienic place in which to work. Second, there is the dollars-and-cents consideration. And third, far beyond any minimum law requirement, there is the benefit which comes from saving human life for its own sake and from lessening family suffering. In short, a good industrial hygiene and safety program achieves practical results by: (1) decreasing illness, injuries, labor turnover and spoilage of materials; (2) decreasing cost to the workers and employers through reduction of wage losses, cost of illness, compensation costs, and insurance premiums; (3) improving health and efficiency of all personnel; and (4) promoting morale.

Under our present system of government, employers of labor have certain responsibilities under the laws of the Nation. These responsibilities are set forth in the rules which follow:

Rule.—(*a*) *Every employer shall comply with the various laws and codes pertaining to the control of industrial health hazards, and shall maintain a safe and healthful place of employment.*

Purpose of Rule.—Management will, of course, meet laws and codes pertaining to the control of health hazards in industry, but it must be borne in mind that such laws and codes present only minimum requirements, and therefore represent only a starting point in a well-designed program of industrial hygiene. It is therefore the duty of management to keep informed of the various laws and codes promulgated in the interests of industrial health maintenance, and in the various changes in them which may be made from time to time. In this way management will be in a position to implement the best known technique in industrial hygiene so that they may achieve a healthful working environment.

Rule.—(*b*) *Every employer shall determine the health hazards in his place of employment by means of a survey of his establishment.*

Purpose of Rule.—It is axiomatic that before a problem can be solved, it has to be defined. Employers will be in a position to solve their health problems intelligently once they know what they are.

Practices for Compliance with Rule.—In the absence of occupational disease, sickness and accident statistics, health hazards may be ascertained by a survey of the working environment. Such surveys are conducted by trained engineers and physicians, whose services are available from official agencies, insurance companies, and private consultants. Modern industrial hygiene practice now has the precise tools whereby specific diseases of occupation and other hazards may be ascertained accurately, and, what is more important, information is now available for the control or prevention of practically all known industrial hazards. By taking advantage of such a survey the employer will learn the extent of his accident problem, of his requirements as to first aid, medical and nursing services, exposure of his workers to various toxic materials and other harmful working conditions. He will also learn of the best methods for the control of such exposures. The employer will find that it will pay him to have such a survey made of his establishment, not only because he will be complying with the rules and regulations pertaining to this problem, but also in the savings which will accrue to him through the reduction of accidents and disease.

Rule.—(*c*) *Every employer shall instruct his employees regarding the hazards to which they are exposed and the methods which have been taken for the prevention and control of such hazards. In all work places where special hazards to health exist, employers shall post a notice of such hazards in a prominent position in the work place, notifying the workers of the hazard and the means for safeguarding against it.*

Purpose of Rule.—Experience has shown that the best results in the prevention of industrial diseases may be obtained by enlisting the cooperation of the worker himself. One method of achieving this objective is by instructing employees regarding the hazards incidental to their work. Whenever employees have objected or have refused to comply with certain regulations, it has been largely due to the fact that they have not been informed of the necessity for such regulations and the benefit which they themselves will derive from compliance with such rules. Workers consider themselves as thinking people and management will find it to be of real benefit to take workers into their confidence, inform them of the hazards of employment, post warnings of the hazards involved and the desirability of the workers' cooperation in combatting such hazards. By such intelligent use of worker resources, employers will not only do a better production job, with a reduction in costs, but at the same time will take a real step forward in establishing the worker as an individual, thereby doing away with one of the main difficulties in the field of labor relations.

Practices for Compliance with Rule.—In the instruction of workers regarding the hazards to which they are exposed, supervising personnel, such as foremen, have been found to be the key people to pre-

sent such instruction. This, a foreman can do on an individual basis. Naturally the foreman himself must first be informed of the hazards and sold on the need for control of such hazards. In some instances, it may be found helpful to give the worker a brief and readable pamphlet on the safe practices with regard to a specific hazardous exposure. Posters have also been found very useful, showing the best practice in the prevention of a specific hazard.

A few of the materials and conditions which require definite instruction of employees regarding the hazards which those materials and conditions present, and the need for posting notices concerning them, follow:

The handling of most chemicals of a toxic or irritating nature, such as certain acids, alkalies, and solvents; heavy metals, such as compounds of lead, manganese, and cadmium; phosphorous compounds; and radioactive materials.

RULE.—(*d*) *Every employer shall install or provide adequate protective equipment for the prevention and control of occupational diseases and shall maintain such equipment at its highest efficiency and in a sanitary condition.*

PURPOSE OF RULE.—The desirability for the employer to provide a healthful working place through various methods, such as protective equipment and devices, is obvious. Information on the best practices of this type are at the disposal of the employer through the .... Of equal importance to the provision of protective equipment and devices is the maintenance of such equipment at its highest efficiency and in a sanitary condition. Management has learned the value of improving and maintaining its machinery of production. Similarly, management will find that it is also essential to maintain the machinery installed for the protection of the worker. Failure to maintain such equipment at its highest efficiency will only serve to give the worker a false sense of security and will contribute materially to his loss of confidence in both the device and in management.

3. *Employee Responsibility:*

RULE.—(*a*) *Every employee shall use the protective equipment provided by the employer for the prevention and control of occupational diseases.*

PURPOSE OF RULE.—Employees should understand that the principal function of the protective equipment provided by the employer is to protect his health, which is his greatest asset, and that therefore he should use such equipment and instruction from the employer in accordance with regulations. Failure to do so may not only result in an injury to the employee and his fellow workers but may also jeopardize the worker's rights under the compensation law in case of injury.

RULE.—(*b*) *Employees shall not abuse or mishandle in any manner*

equipment provided by the employer for the workers' protection against health hazards.

Purpose of Rule.—In order for the protective equipment to function properly, it should not be abused by anyone. The employer has both the right and the obligation to compel the use of equipment for the prevention of industrial diseases.

Practices for Compliance with Rule.—Workers should never refuse to utilize the protective devices given them, nor abuse such devices. Goggles furnished workers to protect them against radiant energy, or against dusts or other foreign objects which may enter the eye, should be worn at all times. The same is true for respiratory protective equipment designed to protect the worker from toxic atmospheric contaminants. Local exhaust ventilating systems and wet methods for allaying dust, such as wet drilling, should be used by the worker in accordance with instructions and any failure of such equipment which the worker may note should be reported to his supervisor immediately. Protective clothing, such as headguards, safety shoes, gloves, aprons, and other equipment of this character, should be worn in accordance with instructions and maintained in satisfactory condition. The employee should remember at all times that occupational diseases are no respectors of persons and sooner or later will exact their toll, if the worker fails to use the protective measures which have been provided him.

Rule.—(*c*) *Every employee shall comply with all healthful practices agreed upon between the employer and employee organization.*

Purpose of Rule.—The employee should realize that the healthful practices recommended by management and by his own organization are designed to prevent injury to himself and to his fellow workers. The employee is often in a position to note unhealthful practices among his fellow workers and is therefore in a position to utilize his influence on his fellow workers to secure compliance with the regulations.

4. *Labor-Management Committees*

Rule.—*In all establishments that have 50 or more employees there shall be allowed the formation of a joint committee of equal representation from employer and employee groups for the exclusive purpose of health maintenance.*

Purpose of Rule.—The increasing interest of labor unions in the health of their members has indicated conclusively the need of a joint approach on the part of management and labor to a solution of industrial health problems.

Practices for Compliance with Rule.—It is conceded that there are difficulties in the way of effective labor-management cooperation in industrial hygiene which must be recognized at the outset in attempting to bring these two groups together. Since management and labor both have so much to gain by cooperative and intelligent application of

industrial hygiene methods, it is tragic that so much misunderstanding and resistance on both sides still exists in many industries. Management often introduces health rules without consulting the workers. The workers have at times used their union strength to oppose measures which would benefit them. There are still many firms and unions whose activities show no evidence of consideration of the health needs of the workers and the necessity for a healthful working environment. Despite new signs of increased interest in workers' health on the part of unions, some segments of labor are apparently still more concerned for compensation benefits than for prevention of conditions which caused the compensable injuries—injuries which can never be compensated by cash benefits. On the other hand, attitudes of management towards industrial health run the entire gamut from paternalism to neglect. In general, most large industrial establishments have adopted an enlightened approach to industrial health measures, which ensure to their workers high quality service and constant attention to the working environment.

What is therefore needed on the part of both labor and management is a new attitude towards the problems of industrial health. The experience in some industrial countries has shown that formula can be devised which will harness the power of labor organizations with the splendid organization which management has created in many plants, so that the two will not oppose each other, but pull together as a team towards the common goal. This was not only true in the field of production, but also in regard to industrial hygiene which is so intimately related to production. We have on record many instances of the effectiveness of labor-management interest in the field of industrial health. These committees, through their joint effort, have been the means of instituting improvements in the medical service and in bringing positive health to the workers through such modern methods as tuberculosis and venereal disease case finding programs, nutrition programs, and welfare programs. There is sufficient evidence to show that health and working conditions are subjects of vital importance to the worker. Labor and management will find that a joint committee to advise both groups on the health needs of the workers and on ways and means to meet these needs will pay dividends. Information on the organization of such a committee can be obtained from the .....

5. *Notification of the Creation of New Establishments, Processes, or Changes of Processes*

RULES—*Every employer shall notify the ..... within 10 days of the establishment of a new enterprise, process, or change in process, and whenever practicable, shall furnish the ..... with plans and specifications of such new or changed processes.*

Purpose of Rule.—Many serious occupational diseases have occurred in industry because of a lack of knowledge on the part of both management and the workers regarding hazards involved through the introduction of new machinery, new chemicals or new processes. It is obvious, therefore, that it would be of distinct benefit to management to keep the ..... fully informed of all the intimate details of operations, especially with regard to the use of new materials and processes, since the ..... has information concerning the control of industrial hazards.

A firm building a new plant will find it of distinct advantage to include at the blueprint stage, health protection features of such a new enterprise. The review of plans and specifications for new operations or changes in operation by the trained technical staff of the .... will save management and labor both in costs and difficulties.

B. Environmental Conditions

1. *General*

Rule.—*There shall not exist in any place of employment any process, material or condition known to have an adverse effect on health unless provisions are present to maintain the occupational environment in such a state as to prevent the existence of a health hazard.*

Practices for Compliance with Rule.—One of the major causes of lost time in industry is workers' ill health, some of it caused by physical conditions in the job environment. Although industrial hygienists now have the techniques to prevent almost any kind of occupational disease, unfortunately, the application of this knowledge has not progressed as rapidly as it has been acquired. The task, then, is the promotion of industrial hygiene techniques, so that they reach every industry in the nation.

Compliance with the general rule enunciated above will enable industry to maintain the health of its workers at a high level. It is also felt that the rule is sufficiently reasonable so as to be reconciled with the chief aim of industry, which is to turn out goods and services in the most efficient way possible, in order to achieve maximum production at a minimum cost.

One way for industry to comply with the above rule is to survey its problems and then take the necessary steps for their control.

To ensure compliance with the rule mentioned above, management will find that it requires three types of services: (1) Medical, (2) Engineering, (3) Welfare.

The medical service should consist of a well-qualified physician or physicians, the necessary nursing service, and other technical assistance from ancillary professions, such as dentistry, medical technicians, and

so on. In order to carry out the medical program there will be required an adequate and well-equipped dispensary.

The engineering service may be obtained from the .... and will serve to present and control environmental conditions in the plant which endanger health. Some industries may find it useful to have health committees to advise and assist in the investigation of diseases and to help to formulate health rules and regulations for the industry, and to see that such recommendations are followed. Some industries will also find it desirable to have at least one trained first aid worker.

In every modern industry there are one or more conditions peculiar to the particular process and operation, which are potential threats to the health of the workers. Most of these can be eliminated or reduced to harmless limits by engineering methods. Further protection of the worker must sometimes be provided by supplying approved devices and clothing. The most important occupational hazards are:

(1) Exposure to poisonous fumes, dusts and gases, which may result in serious, acute or chronic illness;

(2) Excessive noise and vibration;

(3) Poor illumination, such as insufficient lighting, or glare;

(4) Excessive heat, cold, or humidity;

(5) Contact with chemicals and other substances which produce sickness and diseases;

(6) Operations which may result in accidental injuries, burns, cuts, crushing, and so forth;

(7) Overcrowding in the work room;

(8) Poor ventilation in the work room;

(9) Poor housekeeping.

By means of an industrial hygiene engineering survey of all these hazards, they may be appraised by scientific means and the necessary recommendations for controlling them may be obtained. It is wise, once the recommendations have been complied with, to request a resurvey in order to learn whether the recommended changes have accomplished the purpose for which they were made.

There are many other problems in industrial hygiene in addition to those specifically caused by unhealthful conditions. Many of these may be solved or controlled by the application of certain welfare provisions. Industries have found it of distinct advantage to see to it that their workers have proper housing, sewage disposal, safe water supply, safe milk supply, safe and nutritious food, and at times to have programs to advise workers on their personal problems, and a general health education program.

With regard to the environmental control of working conditions, it is desired to emphasize once more the importance of investigating, in advance of installation, all the processes, materials, or modifications, in

order to prevent the introduction of unexpected exposures; and finally, too much stress cannot be given to the importance of maintaining control measures through periodic plant inspections and maintenance.

2. *Maximum Allowable Concentration for Atmospheric Contaminants*

RULE.—*There shall not be used any process or material which will liberate any contaminant into the atmosphere of occupied areas, unless arrangements are present to prevent the contaminant from injuring any part of the body or reducing in efficiency the normal function of any part of the body. The maximum allowable concentration for atmospheric contaminants in occupied areas shall include, but is not restricted to, the following substances and their corresponding maximum allowable concentration values.*

GASES AND VAPORS

(Parts per million)

Substance	*Concentration*
Acetone	500
Acrolein	0.5
Ammonia	100
Amyl acetate	200
Aniline	5
Arsine	0.05
Benzene	35
Carbon disulfide	20
Carbon monoxide	100
Carbon tetrachloride	50
Chlorine	1
Ethyl ether	400
Formaldehyde	5
Gasoline	500
Hydrogen chloride	5
Hydrogen cyanide	10
Hydrogen fluoride	3
Hydrogen sulfide	20
Methanol	200
Naphtha (coal tar)	200
Nitrogen oxides	25
Nitroglycerine	0.5
Phosgene	1
Stibine	0.1
Sulfur dioxide	10
Trichlorethylene	100
Toluene	200

TOXIC DUSTS, FUMES AND MISTS

(Milligrams per cubic meter)

Substance	*Concentration*
Antimony (metal and oxide)	0.5
Arsenic (metal and oxide)	0.5
Cadmium	0.1
Chromic acid	0.1
Lead	0.15
Mercury	0.1
Zinc oxide	15

MINERAL DUSTS

(Million particles per cubic foot)

Substance	*Concentration*
Asbestos	5
Silica (more than 70%)	5
Silica (40% to 70%)	10
Silica (5% to 40%)	20
All dusts (less than 5% silica)	50

RADIATION

X-rays	0.1 roentgen unit per 8 hour exposure

Purpose of Rule.—By limiting the exposure of workers to the concentration values listed in the rule, reasonable assurances will be obtained that the workers will not be injured or their efficiency and well-being impaired.

Practice for Compliance with Rule.—There is at present available a sufficient body of knowledge regarding the toxicity of many materials employed in industry, so that they may be limited in the atmosphere of occupied places to safe concentrations. Some of the limits for atmospheric contaminants are based on clinical and physical information, while others find their basis in what can be accomplished through good engineering practice. Industrial hygienists feel that it is their duty not only to prevent injury to the worker's health but also to make him reasonably comfortable and efficient in his working environment. In other words, not only must we prevent a worker from being poisoned, but we must also prevent physiological responses which cause discomfort and unpleasantness, but not necessarily injury to health. Enlightened management has found that it is good operating practice to control the working environment, so that even mild physiological responses that are causing discomfort are kept at a minimum. In fact, it is a good practice to keep them at a minimum because quite frequently such uncomfortable conditions make a worker accident-prone, as, for example, when a worker becomes inebriated from inhaling certain kinds of solvent vapors. No one in industry has questioned, for

example, the standards adopted in the United States for chromic acid mists resulting from chromium electro-plating operations. These mists do not cause systemic injury, but do produce, under certain conditions, irritation of the mucous membranes and destruction of part of the nasal septum. Through educational efforts in the electroplating industry itself, it has been a relatively simple matter to obtain good operating techniques, so that chromic acid levels are kept well below the point where these minor injuries and discomforts can occur.

The limits set forth in the above rule are capable of attainment through good engineering practice. They have been found, on the other hand, to cause no serious handicap to industry in the matter of compliance. Administrative agencies, however, should realize in the enforcement of this rule that the determination of whether a working condition is safe or unsafe, depends on other factors besides that of maximum allowable concentration in the atmosphere. Before an industry is told that it should make certain provisions to control conditions suspected of being inimical to health, a complete survey is in order. Such a survey should involve at least two criteria in determining the safety of an operation. First, it is essential that the health of those workers exposed to a certain material or condition should be carefully investigated. This may involve not only an examination of the worker's health record, but also an examination of the worker himself. Second, careful environmental studies should be made which would include not only certain determinations of the atmosphere, but also a thorough sanitary survey and occupational analysis. The sampling and determination of atmospheric contaminants should be made by approved and standard procedures. All these, put together, should yield data of real value in helping to control industrial health hazards.

Certain sections of this discussion present details for maintaining safe atmospheric concentrations.

3. *Skin Contact with Hazardous Material*

Rule.—*Where the substances encountered are capable of causing any pathological change in the skin, adequate precautions shall be taken to prevent these substances from contacting the skin.*

Where the substances encountered are capable of being absorbed through the skin or mucous membrane thereby producing injury to health, adequate precautions shall be taken to prevent these substances from contacting the skin and/or the mucous membrane.

Purpose of Rule.—Most chemicals either in the pure form or in solution can cause dermatitis when in contact with the skin over a prolonged period of time; consequently, most chemicals may be hazardous for repeated daily industrial contact. Although dermatoses are usually not serious, they may be prolonged and cause considerable economic loss both to workers and employers. Furthermore, a few chemicals may be absorbed through the skin and cause systemic poison-

ing. Most notable among these are tetraethyl lead, mercury, and hydrogen cyanide. The purpose of the rule is therefore to prevent injury by repeated contact with such agents.

Practices for Compliance with Rule.—Continuous or repeated contact with dermatitis-producing agents such as organic chemical solvents, solutions of or solid caustic, and organic chemical dusts may be prevented by isolation of the worker from the material, by exhaust ventilation, by the use of protective clothing, and by supplementary washing facilities.

By isolation is meant complete removal of contact of the skin with chemical agents. Thus, liquid chemicals should be handled in pipes and closed vessels rather than in buckets or other open vessels. This procedure not only eliminates contact, but also reduces the likelihood of spillage of material on the clothing which may cause continuous contact. Another manner of isolation is the use of mechanical equipment for dipping parts into solutions. This may be a mass production arrangement of the use of tongs or other manual handling devices. These arrangements are particularly useful for dip painting, for pickling and metal cleaning in general, and for impregnating operations.

Exhaust ventilation should be used to remove from the working environment irritating chemical dusts which may settle on the skin of the worker thereby causing dematitis or other injury. Processes involving the use of alkali powders or organic dusts which may escape into the atmosphere should be ventilated. (See section on ventilation.)

Protective clothing should be used when other means fail to prevent the contact of the skin with harmful chemicals. The purpose of such equipment is to prevent such material from touching the skin when splashed, settled, or reached into.

Protective clothing for this purpose includes gloves, gauntlet gloves, full arm covering, face shields, full head covering, aprons, jackets, pantaloons, and footwear. The clothing must be impervious to the material in question, otherwise, it may soak in and be in continuous contact with the skin. Impervious clothing includes that made of rubber, synthetic rubber, synthetic plastics, or cloth impregnated with these materials. It may also include items made of asbestos for protection against physical burns. The use of protective skin ointments is not recommended except for very brief exposures to relatively mild chemicals. In connection with the use of such protective equipment, guidance should be sought from the plant physician.

Supplementing the previously mentioned means, adequate washing facilities should be available for workers exposed to dermatitis hazards. After every work shift and at least once during the shift, such workers should wash extraneous chemicals from the skin. This implies that the employer should furnish hot and cold running water, an adequate basin, washing soap, and drying facilities. In cases where the poten-

tially irritating material may contact the body as a whole, shower baths should be furnished. It is clearly the responsibility of the worker to use these facilities.

In some instances when it is impossible to avoid irritating chemicals getting on the clothing, clean clothing should be furnished to the workers at regular intervals to prevent repeated contact of the skin with contaminated clothing. Such clothing may be furnished at intervals of from one day to one week depending on the severity of the hazard.

In all of the above mentioned recommendations, good housekeeping and cleaning up of the spilled chemicals is implied. (See section on housekeeping.)

The handling of tetraethyl lead must be done with the utmost care to prevent skin contact. Tetraethyl lead or its mixture with other organic liquids should be contained in closed vessels and pipes and all contact with the chemical must be avoided by the means mentioned above. Exposure to hydrogen cyanide should not be over 1 percent by volume in the air even for the worker protected from breathing such a concentration, since the gas is absorbed through the skin in such concentrations.

4. *Infectious Agents*

Rule.—*There shall not exist in any occupied area any processed or unprocessed material containing infectious agents unless provisions are present to prevent the infectious agents from injuring any part of the body or reducing in efficiency the normal function of any part of the body.*

Purpose of Rule.—In certain types of industry such as animal husbandry, tanning, hide-handling, and cattle slaughtering it is possible that infections, present in the animals, may be transmitted to workers. The purpose of the rule is to prevent the occurrence of such infections in workers handling potentially infected animal products.

Practice for Compliance with Rule.—Of primary importance is the prevention of diseases in the animals. To this end, herds should be inspected for anthrax and glanders, and infected animals should be disposed of in such a way that the infection cannot be transmitted.

In the handling of animal carcasses and hides, protective clothing should be used for two purposes. In the first place, direct contact of workers with hides and carcasses should be prevented as far as possible. In the second place, protective clothing should be used to prevent the occurrence of cuts and abrasions among workers handling the materials. Every precaution should be taken to thoroughly disinfect cuts and abrasions when they do occur, since the infecting organism usually enters the human body through the broken skin. Protective clothing should be kept clean and in a sanitary condition. Some

industries may find it necessary to thoroughly disinfect hides, wool or carcasses before processing them.

In addition good personal hygiene must be practiced by the workers. This implies that the employers in establishments where such infectious diseases may occur should provide adequate lockers, change rooms, soap and towels, and washing facilities with running water. All clothing which comes in contact with potentially infected material should be laundered and disinfected. It is preferable that the employer furnish clean clothing to workers at regular intervals.

5. *Illumination*

Rule.—*The quality and quantity of illumination in any occupied area shall be adequate to permit the performance of all necessary work in a safe manner and without injury to the eyes.*

Purpose of Rule.—Illumination is a necessary factor in the environment where any type of work is done, and it must be available whenever work is in progress. Since most tasks require visual effort to a greater or less degree, the amount of illumination available must be sufficient for the eyes to see the work. However, it is possible for excessive quantities of light to reach the eyes without improving the illumination on the work being done. Such excessive illumination may injure the eyes over a period of time.

On the other hand, lack of illumination is a potential cause of accidents, loss of efficiency, inaccuracy, and reduced production. The purpose of the rule therefore is to insure that the working environment is satisfactorily illuminated in agreement with reasonable standards.

Practices for Compliance with Rules.—Lighting may be from natural sources during daylight hours or from artificial sources. In some cases a combination of both is required. The most easily accomplished illumination is by the use, during daylight hours, of windows and skylights. It should be assured, however, that no working place or other occupied area is at too great a distance from the source of illumination to be adequately lighted.

Artificial illumination may be provided by electrical lighting or other equivalent means. For such artificial illumination, two general arrangements are possible; namely, general illumination and local or spot illumination. The latter should be used primarily as a means of supplementing general illumination at those work points where especially good lighting is needed. General illumination means that lighting is available over a more or less large area. Lights for this purpose should be placed at least three meters above the floor and should diffuse the light downwards. Lighting fixtures for this purpose should be spaced at such intervals that the illumination at an elevation of one meter above the floor level is approximately equal in all parts of the working area. This same general standard should apply to natural illumination provided by windows and skylights.

Spot illumination implies the stronger lighting of a small area and is usually accomplished by means of electrical fixtures. Such illumination should be used for tasks requiring greater visual effort than is needed in other parts of the working area. The light should be so arranged that it produces the necessary effective illumination at the point of work.

In all cases, the quality of the light must be such as not to impair the vision. The major lighting difficulty is that of glare which is either a reflection or a direct radiation of the light to the eyes from its source. Such glare greatly reduces the visual acuity. It may be overcome by facing the worker away from the source of illumination or by interrupting reflections from smooth surfaces. Such a smooth surface may be painted a dull light-absorbing color or may be replaced by a rough surface. Direct glare from light sources should be reduced by means of properly shaded light fixtures or by interposing a barrier in front of the light source.

Another quality of illumination is the color, not only of the source but of the surrounding reflecting surfaces. In general, the darker colors are more comfortable for the eyes, but the lighter colors reflect and make useful more of the light. Walls and ceilings should be painted with light colors, whereas work benches, floors and other surfaces on which the work is done should be painted with darker colors.

It is possible also to simplify visual tasks by means of contrasting colors. This implies that the background is of a different color than the parts being worked on, or that the different parts of moving machinery are painted with contrasting colors so that they are readily distinguished one from another. In such cases the moving parts which create the danger should be painted a light color against a dark background.

The maintenance of the source of illumination should be carefully attended to. This implies that windows, lights, and light fixtures should be washed at frequent intervals in order to maintain their efficiency. Walls, ceilings, and other light-reflecting surfaces similarly should be kept clean. Burned out light bulbs should be immediately replaced.

Illumination may be measured by means of instruments which indicate the number of foot-candles of incident light at a given point. Therefore, it is suggested that specific quantities of illumination should be available for various types of work depending on the visual requirements of the work. Attention to fine details, for example, requires a relatively high level of illumination, whereas the simple act of walking on cleared floors or stairways requires a low level of illumination. The following table should be considered as a guide to the minimum quantity of illumination which should be available for different general types of visual tasks:

Visual task	*Foot-candle*
1. Walkaways—and near moving machinery	3-5
2. Stockroom and low seeing requirements	5-10
3. Coarse work (such as casting, machine tending)	10-20
4. Coarse work at hazardous machinery (and moderate seeing tasks)	20-30
5. Fine machine and bench work, fine inspection (and other exacting seeing tasks)	30-50

6. *Temperature, Humidity and Air Movement*

Rule.—*Natural or mechanical ventilation shall be provided in all occupied areas to insure a healthful and, so far as feasible, a comfortable environment with regard to temperature, humidity, heat radiation and air movement.*

Purpose of Rule.—This rule implies that attention should be given to the temperature and humidity of the air in workrooms even when no possibility exists of the persons in the room being exposed to harmful contaminants. It has been found that the physical conditions of the air affect the efficiency of the workers, and in extreme conditions their health as well. The most comfortable conditions for specific types of work are usually those under which the work is best performed. Arduous labor, for example, may be accomplished at relatively low temperatures, whereas sedentary work is best done at a temperature of about 21° centigrade.

The humidity and motion of the air also has its effect upon comfort and upon health. Certain combinations of air temperature and humidity make work impossible and injurious, although the addition of a strong localized air movement may alleviate the conditions.

The purpose of this rule is to suggest conditions and limitations concerning temperature, humidity and air movement as related to the environment of work places.

Practices for Compliance with Rule.—Aside from the special ventilation required in some working locations to remove atmospheric contaminants from the environment, general ventilation should be available to provide some fresh air in all occupied areas. This may be accomplished by means of natural ventilation, which implies that a sufficient number of openings are available in the building or other structure, or by mechanical means. The latter implies that power-driven fans are used to force air into or to remove air from the occupied enclosures or structure.

On the average, approximately one-half cubic meter of air per person per minute should be changed within an occupied area in order to maintain comfortable conditions. If natural ventilation is utilized to accomplish this air change, the relative area of windows and other openings used for ventilation should be about 10 percent of the floor area served by the ventilation. Since ventilation is related to the occupancy of the building, it is suggested that the space volume per person in the workroom or place should be at least 10 cubic meters.

When outdoor conditions are very cold, it is preferable that the entering air be heated almost to the room temperature and that it enter the space without creating a draft in areas occupied by workers. This may be accomplished by placing baffles inside the windows or by placing the air inlets at a height of at least 3 meters above the floor level and directing the air current upwards.

The entrance of fresh air into a building or space implies that an equivalent amount of air leaves the building or space. Thus air outlets as well as inlets must be furnished if general ventilation is to be operable.

The temperature of occupied areas may be raised by the use of heating devices such as unit electric heaters, central heating systems, gas, oil, wood or coal burning unit heaters, or other means. Care should be taken that unit furnaces have good stacks and draft, so that carbon monoxide and other gases do not escape into the working area. (See section on maximum allowable concentrations.)

Humidity is closely related to temperature as it affects the air conditions of an environment. Relative humidity means the actual amount of water vapor in the air as related to the maximum amount of vapor which could be present at a given temperature. With high atmospheric humidities, it is impossible to cool the human body by evaporation. This implies that certain combinations of air temperature and humidity may be injurious to health. Quantitatively, the wet bulb temperature should not be above 32° centigrade, if the dry bulb temperature is as high as 49° Fahrenheit. For the most part, a relative humidity between 30 and 70 percent is the most comfortable for temperature ranging from 5 to 27° centigrade.

Processes within the working place may add either to the temperature or to the humidity of the area. It is not intended that these suggestions should limit this effect except to the extent that unhealthy conditions should not exist. Where furnaces or other high temperature equipment are in use, ceilings should be high and extra amounts of fresh air should be brought into the working environment by ventilation. When excessive humidity is created by processes or conditions which are not necessary to the process, extra ventilation should also be provided above the suggested amounts, in order to maintain reasonably comfortable conditions.

In specific hot locations such as work areas in front of high temperature furnaces, a blast of air may be directed on the workers in order to make their work more comfortable provided that the humidity of the air is not excessive. Such an air blast should be of approximately the same temperature as that of the air in the working area in order not to create unhealthy conditions. Other means are also available to cool individual workers in particularly hot environments, such as the inside of partially cooled boilers or kilns. These consist of asbestos suits

within which a blast of fresh air is introduced by hoses from a cooler environment.

For protection of workers against heat radiation from high temperature sources such as furnaces, reflecting metal shields may be imposed between the worker and the source of heat without interfering with the work to be done. Asbestos clothing such as gloves, arm coverings, aprons, and face shields may be provided to protect the worker individually.

It is not intended that these practices should imply the need for air conditioning in hot climates or in hot environments. However, where hot environments occur industrially in cool or cold climates, change houses or rooms should be provided, so that workers may change clothing and bathe with warm water before being exposed to the cold conditions after the work shift.

7. *Noise*

Rule.—*There shall not exist in any occupied area any process or operation producing noise unless provisions are present to prevent the noise from injuring any part of the body or reducing in efficiency the normal function of any part of the body.*

Purpose of the Rule.—Noise may be defined as an excess of sound of any pitch. Such sound excesses are known from experience to produce over a long period of time, not only fatigue and inefficiency in exposed persons, but, in extreme cases, impaired hearing. The hearing may be impaired for a small range of the wave lengths which constitute sound or for nearly all of the audible wave lengths, in which case a condition approaching total deafness occurs. The purpose of the rule is to reduce the possibility of such injury.

Practices for Compliance with Rule.—Industrial noise is usually the result of machinery operation, of the escape of the use of compressed air in pneumatic tools, or of fabricating heavy metal parts. Friction and vibration frequently play a major part in the production of noise. The first approach to noise reduction, therefore, is the reduction by maintenance of friction and vibration in moving parts of machinery. This elimination of noise at its source includes the replacing of worn parts and oiling of moving parts such as gears and bearings. Other means of eliminated source noises include the mounting of machinery on rubber or on solid foundations, the use of direct or belt drives in place of open gears, or the enclosing of such gears in nonvibrating housings.

Other means of noise reduction are the isolation of noise producing operations, the use of sound insulation, and the use of personal protective devices. Frequently, the noise producing equipment may be removed from a main workroom to another location where a relatively small number of persons will be exposed. If such a location is sound

insulated, very little sound will escape to the main workroom and the noise exposure of the operators will be reduced to a minimum.

Sound insulation may be used not only in small enclosures such as mentioned above but also in large workrooms. Sound insulation is a means for reducing reverberations within a workroom or other enclosed space. By sound insulation is meant the lining of the enclosure or room with sound-absorbing materials. Such materials may be heavy tapestry or cloth hanging one or two inches away from a wall, or soft perforated material, such as composition board, lightly but firmly attached to the walls and ceiling. Such sound insulation will appreciably reduce sound levels in noisy areas.

For protection of individuals unavoidably exposed to excessive noise, personal protection should be provided. This protection may take the form of lightly oiled cotton plugs which may be placed in the outer ear canal, or of commercial ear defenders, which will serve the same purpose of reducing the intensity of noise vibration reaching the eardrum. As in the case of other personal protective equipment, the more permanent means of noise elimination should be used as much as possible. These more permanent methods include elimination of noise at its source, isolation of noisy operations, and the use of sound insulation.

8. *Vibration*

Rule.—*Wherever any process or operation producing vibration is conducted in any occupied area, provisions shall be present to prevent the vibration from injuring any part of the body or reducing in efficiency the normal functions of any part of the body.*

Purpose of Rule.—Certain industrial operations, particularly those requiring the use of pneumatic tools, create rapid and vigorous vibration which without adequate precautions may be translated directly to the person performing the work. Excessive vibration of this type may produce injury to the peripheral nervous system and to the joints of the body. The purpose of the rule is to prevent such injury.

Practices for Compliance with Rule.—Vibration as interpreted in this rule should not be confused with noise associated with the use of pneumatic tools. (See section on noise.)

The first means of preventing excessive vibration is to change the process where possible. For example, welding may be practical in place of riveting.

Insofar as possible pneumatic tools should be held in position mechanically, particularly in the case of the medium weight tools which have a high impact. Such mechanical holding will prevent the translation of the vibration to the worker. Where it is not possible to hold the tools mechanically, workers should be provided with padded gloves or with other resilient padding which prevents direct contact of the tool with his person. In cases where direct contact of the vibrat-

ing tool can not be avoided, the length of daily contact with the vibrating mechanism should be kept at a minimum.

9. *Pressure*

Rule.—*In occupied areas where the workers are subjected to abnormal atmospheric pressures, provisions shall be present to prevent injury to any part of the body or reduction in efficiency of the normal function of any part of the body of the worker upon entering, working in, or leaving that area.*

Purpose of Rule.—Both excessive and diminished air pressures may have a profound physiological effect on the human body. With diminished pressures, such as are encountered at high altitudes, the lack of oxygen may produce excessive fatigue and other effects. Excessive air pressure may be encountered where work is done under water or under ground when the pressure must be increased to exclude water. Subsequent effects of such increased pressure may cause the condition known as "bends." The purpose of the rule is to prevent the occurence of such physiological maladjustment.

Practices for Compliance with Rule.—Life and work may be accomplished at altitudes as high as 5,500 meters, provided that time is allowed for adjustment of the individuals to such altitudes. At high altitudes the oxygen available for respiration is considerably reduced, and the lack of oxygen is partially compensated for by changes in the blood physiology. These changes require several months' time before complete adjustment is made.

For any kind of work in altitudes above 5,500 meters oxygen should be furnished from a known safe supply. This implies that a source is available at all times and in a portable manner.

Increased air pressure, greater than that encountered at sea level, may be used for tunneling and shaft sinking where water must be kept out of the working place. Under no conditions should the pressure be more than 5 atmospheres if the work is to continue for a full 8 hour shift. Persons should not be subjected to pressures greater than 5 atmospheres for more than 1 or 2 hours at a time.

In no case where work must be done under increased atmospheric pressure should the increase or decrease of pressure be made at a rapid rate. The pressure decrease to normal should be made according to standard practices in time intervals such as shown below.

This stepwise decrease of pressure largely eliminates the possibility of occurrence of "bends." In addition there should be available an auxiliary compressed air chamber in which affected individuals may be recompressed and returned to atmospheric pressure at even slower rates. A supply of oxygen should be available in such a recompression chamber for additional relief of pressure effects.

Table I.—*Pressure shifts and intervals of work for each 24-hour period*

Pressure		Hours			
Column 1	Column 2	Column 3	Column 4	Column 5	Column 6
Minimum number of pounds	Maximum number of pounds	Maximum total	Maximum first shift in compressed air	Minimum rest interval in open air	Maximum second shift in compressed air
[1]	18	8	4	½	4
18	26	6	3	1	3
26	33	4	2	2	2
33	38	3	1½	3	1½
38	43	2	1	4	1
43	18	1½	¾	5	¾
48	50	1	½	6	½

[1] Normal

DECOMPRESSION

No person employed in compressed air shall be permitted to pass from the place in which the work is being done to normal air, except after decompression in the intermediate lock as follows:

A stage decompression shall be used in which a drop of one-half of the maximum gauge pressure shall be at the rate of 5 pounds per minute. The remaining decompression shall be at a uniform rate and the total time of decompression shall equal the time specified for the original maximum pressure.

(*a*) Where the air pressure is greater than normal and less than 15 pounds to the square inch, decompression shall be at the minimum rate of 3 pounds per minute.

(*b*) Where the air pressure is 15 pounds or over and less than 20 pounds to the square inch, decompression shall be at the minimum rate of 2 pounds per minute.

(*c*) Where the air pressure is 20 pounds or over and less than 30 pounds to the square inch, decompression shall be at the minimum rate of 3 pounds every 2 minutes.

(*d*) Where the air pressure is 30 pounds or over to the square inch, decompression shall be at the minimum rate of a pound per minute. The time of decompression shall be posted in each man lock.

(*e*) Where air pressure reaches seventeen pounds, a record of all men working in the air chamber shall be kept by a man detailed for that purpose, who shall remain outside the lock, near the entrance. This record shall show the period of stay in the air chamber of each person and the time taken for decompression.

10. *Radiant Energy*

RULE.—*Wherever any type of radiant energy is emitted into an occupied area, provision shall be present to prevent these radiations*

from injuring any part of the body or reducing in efficiency the normal function of any part of the body.

Purpose of Rule.—Outside of visible light there are a number of known types of radiation which by their physical effect may injure the eyes, the skin, or the body mechanism as a whole. The principal radiations in this category are infra-red and ultraviolet which are very close in wave length to visual light, and X-radiation, which has an extremely short wave length. Classified with X-radiation and having similar effects are gaseous emanations from radioactive materials and other radiations such as alpha, beta and gamma rays. Although X-radiation and its associated components are the most dangerous, (see maximum allowable concentrations), infra-red and ultraviolet are the most frequently encountered. The purpose of the rule is to reduce the likelihood of injury to workers using equipment producing radiation or to other workers who may be exposed due to their proximity to such equipment.

Practices for Compliance with Rule.—Two general methods are available for reducing exposure of workers to radiation; namely, shielding and personal protection. In the first place, all equipment producing radiation should be isolated from the general work area by means of proper barriers. This will reduce the possibility of radiation reaching persons who are not intimately concerned with the equipment which produces the radiation.

Ultraviolet radiation is encountered industrially principally in welding, either electrically or with gas. Although the intensity of such ultraviolet radiation is reduced inversely as the square of the distance from the source, enclosures or barriers should be provided for welding work to prevent the radiation reaching others in the vicinity. At stationary welding operations, permanent or semi-permanent fire resistant walls should be erected around the operation, extending from a distance of one-half meter from the floor level to approximately 2 meters above the floor. The inside of such enclosures should be painted dull black to reduce reflection. For portable welding equipment movable shields painted dull black should be placed around the welding operation to prevent radiation from reaching other persons in the vicinity.

Infra-red radiation is that produced by high temperature heat sources, such as glass furnaces, metal furnaces, and other types of industrial heating equipment. These are usually permanent installations, and either permanent or movable fire resistant shields should be so placed as to prevent the radiation from reaching the workroom in which they are located.

Sources of X-radiation, either industrial or medical, should be located within enclosures which prevent the incident of potentially reflected radiation from reaching other workers or the general public.

Enclosure for such equipment may be of concrete or lead, or of other material of equivalent capacity to absorb the radiation. For X-ray equipment up to 500 milliamperes capacity, a 2 millimeter thickness of lead or a 2 centimeter thickness of concrete will provide protection: up to 1,000 milliamperes, 3 millimeters of lead or 3 centimeters of concrete are needed.

Personal protection for the operators of equipment which produces radiation should also be provided. Welders and helpers working with either electric or acetylene equipment should wear both eye protection and fire resistant clothing which covers the hands and body. Eye protection may be provided by means of goggles or helmets, the latter being preferable, having a lens shade of sufficient density to allow clear vision of the object being welded while reducing intensity of light to the eye to the point where there is no glare. Suggested filter densities are shown in the following table:

"Shade Nos. 3 and 4 filter lenses are intended for glare for reflected sunlight from snow, water, roadbeds, roofs, sand, etc., for stray light from nearby cutting and welding operations, and for metal pouring and furnace work.

"Shade No. 5 filter lenses are intended for light gas cutting and welding, and for light electric spot welding.

"Shade No. 6 filter lenses are intended for gas cutting, medium gas welding, and for arc welding up to 30 amperes.

"Shade No. 8 filter glasses are intended for heavy gas welding, and for arc cutting and welding exceeding 30 but not exceeding 75 amperes.

"Shade No. 10 filter lenses are intended for arc welding and cutting exceeding 400 amperes.

"Shade No. 12 filter glasses are intended fer arc welding and cutting exceeding 200 but not exceeding 400 amperes.

"Shade No. 14 filter glasses are intended for arc welding and cutting exceeding 400 amperes."

Persons intimately working with X-ray equipment may be partially protected by the use of leaded clothing, particularly gloves and aprons. So far as possible, persons operating X-ray equipment should work from behind the enclosing barrier. This implies that the controls for such equipment are outside of the room which houses it. It should be emphasized that, as far as possible, protection from X-rays and similar radiations should be of a permanent nature and should be obtained by engineering control measures incorporated in the design and installation of the equipment.

(See tables 3 and 4, pp. 28 and 29, in American Standards Association: Safety Code for the Industrial Use of X-rays, Part 1, Z54.1, 1946, 70 East Forty-fifth Street, New York 17, N. Y.)

11. *Ventilation*

RULE.—*Where excessive amounts of contaminants may be liberated*

into the atmosphere of occupied areas, adequate ventilation systems for their removal shall be installed, maintained in good condition, and operated efficiently at all times when work is being done.

The discharge air of a ventilating system shall not be permitted to re-enter the same or other working areas and shall not constitute a health hazard or nuisance in the community. Plans and specifications for all ventilating systems shall be submitted to the .... for approval prior to their installation.

Purpose of Rule.—One of the accepted means for reducing atmospheric contamination is by the use of ventilation. Many materials and processes used industrially have been found to have harmful effects on the body (see section of maximum allowable concentrations). The purpose of this rule is different from that in the section Temperature, Humidity, and Air Movement. In many cases, ventilation must be provided to remove from the working atmosphere industrial contaminants which may be harmful. It is essential that such ventilation systems be properly designed and adequately maintained to accomplish their purpose. Any contamination removed from the working environment by such ventilation systems should not be allowed to re-enter the working place nor should it enter any other inhabited area in sufficient concentration to be harmful or to create a nuisance.

Practice for Compliance with Rule.—Two types of ventilation may be used for removal of contaminants from occupied areas; namely, general dilution ventilation and local exhaust ventilation. General ventilation implies that the air in occupied areas is changed frequently, so that fresh air replaces contaminated air. Such air changes must insure that contamination in the workroom is maintained below the maximum allowable concentration. Usually this requires a larger volume of air than the amount suggested in the section on Temperature, Humidity, and Air Movement. Frequently general ventilation alone is not a satisfactory means of providing a safe environment but is only supplemental to other means. For example, in mining operations wet methods of dust control should be utilized to prevent excessive contamination of the air, and general ventilation as a supplemental means to remove from the working space the incidental dust which is produced even with the proper use of wet methods.

General ventilation may be induced either by natural means or by the use of fans and blowers to force air into or out of the work place. Where either general or local exhaust ventilation is used, it is necessary to insure that the air inlets are approximately equivalent to the air outlets. This will insure that excessive resistance to air motion does not occur over the ventilation system as a whole.

Local exhaust ventilation is a means for removing air contamination at or near its source so that such contamination does not enter the air of the working area. The component parts of a local exhaust ventila-

tion system are: (1) the hood into which the contaminant is directed; (2) the piping system for transportation of the contaminant to a point of safe dissipation; (3) the air moving mechanism to move air and contaminants through the system; and (4) in some cases a collector for preventing dispersal of the contaminant into the surrounding atmosphere.

The hood of a local exhaust ventilating system may take many forms, but must be designed properly to collect the contaminant at its source. The more nearly a hood encloses the source of contamination, the more nearly it will accomplish its purpose. Complete enclosure is not always possible because of the requirements of the work. Other types of hoods include partial enclosures, canopy types, booths, open-end pipes, and open-end pipes with flanges. The variations of these hood types must be specifically adapted to the work for which they are designed.

The piping system should be so designed that the air and contamination moving through it does not encounter excessive resistance. The piping system should extend from the hood to a safe point of discharge in the atmosphere outside of the working place. It should be maintained so that all joints are tight and so that solid material does not collect inside, thus reducing the flow of air. Removal traps may be installed in the piping system to collect solid materials. Clean-out openings may be installed at such points that cleaning of the inside of the piping is possible.

The air-moving force may be either natural or induced by fans or ejectors. A natural air-moving mechanism implies that a temperature differential exists which will create a movement of air into the hood and piping system or that some other natural force such as wind may be utilized. In such installations, the stack must always be of a large diameter and vertical, without bends, which impose resistance to the air movement. For the most part, induced air movement by the use of blowers is the most satisfactory means for removing contaminants.

The fan or ejector should be of sufficient capacity to move the necessary volume of air through the hood, piping system, and collector. Resistance to air movement will be encountered at the hood opening, within the pipe, at pipe bends and at transition points. The volume of air which must be removed through the system will depend upon the proximity to the source of contamination.

Collectors may be utilized in this type of system to remove dusts, fumes, vapors, or gases from the air in the system before it is discharged to the atmosphere. They are not a necessary part of the system provided that the air is discharged in such a way that it will not reenter a working area or contaminate the general environment. For the most part, the discharge point of a ventilation system should be completely outside of the working area and preferably above the roof

line. If ventilating systems discharge horizontally, the discharge point should be at least three meters distant from the nearest building opening.

12. *Respiratory Protective Equipment*

Rule.—*When exposures to excessive amounts of atmospheric contaminants are intermittent and of brief duration, or where ventilation or other control methods are impractical, the workers shall be protected by means of respiratory protective equipment. Such equipment shall give adequate protection against the specific contaminant under the conditions encountered and shall be of a type approved by the*

. . . . . .

Respiratory protective equipment shall be employed only under the conditions above stated and shall not be used in lieu of other control methods of a more effective and permanent character.

Purpose of Rule.—In the absence of more permanent types of control procedures as a protection against atmospheric contaminants, approved respiratory protective equipment will ensure the health of the worker.

Practices for Compliance with Rule.—It is generally conceded that in the control of exposures to harmful atmospheric contaminants, first consideration should be given to procedures for preventing contamination of the air to a harmful degree in the breathing zone. However, there are situations where for various reasons such procedures may be inapplicable, impracticable, or not effective. For these situations respiratory protective equipment may be indicated, either as a primary method or as an adjunct or supplement to other procedures.

The following classification of respiratory protective equipment will serve to elucidate the various types of respirators, their general design features and the protection provided in various situations:

RESPIRATOR CLASSIFICATION

Respirator	General design features	Protection provided
I. Air-purifying respirators	Filter (chemical or mechanical, for removing contaminant or contaminants from inhaled air) and face piece attached to filter directly or by means of short length of flexible rubber tubing. Entire device is carried by the wearer.	Against specific contaminants or types of contaminants. No protection against atmospheres deficient in oxygen.
A. Chemical-filter respirators	Canisters or cartridges containing suitable chemicals attached directly or by means of short length of rubber tubing to full face piece or half mask.	Against gaseous contaminants.
1. Gas Mask	Canisters with chemicals for individual gases or combinations thereof.	Up to 3 percent ammonia and 2 percent most other gases and/or vapors.

RESPIRATOR CLASSIFICATION — Continued

2. Chemical-cartridge respirators	Cartridges with chemicals for individual gases or combinations thereof.	Against very low or nuisance concentration of gases and/or vapors.
B. Mechanical-filter respirators (commonly called dust respirators)	Fibrous filter attached to half mask face piece directly or by means of a short length of flexible rubber tubing.	Against particulate contaminants.
1. Dust	Fibrous filter attached to half mask face piece directly or by means of a short length of flexible rubber tubing.	Against dusts of all kinds.
2. Fumes	Fibrous filter attached to half mask face piece directly or by means of a short length of flexible rubber tubing.	Against fumes of various metals. Since fumes are probably more difficult to remove by mechanical filtration than other kinds of particulate matter with the possible exception of smokes, this respirator will protect against such particulate matter as dusts and mists.
3. Mist	Fibrous filter attached to half mask face piece directly or by means of a short length of flexible rubber tubing.	Against mists as produced by spray-coating with paint and vitreous enamels, chromic acid mist as produced in chromium plating, and mists of other materials whose liquid vehicle does not produce harmful gases or vapors.
C. Chemical and mechanical-filter respirator	Chemical and mechanical filter attached to face piece directly or by means of a short length of flexible rubber tubing.	Against combinations of gaseous and particulate contaminants.
II. Supplied-air respirators		
A. Hose mask with blower	Blower (manual or power-operated) large diameter hose, harness, and face piece.	Against any atmosphere.
B. Hose mask without blower	Large diameter hose, harness and face piece.	Against any atmosphere, but should not be used in immediately harmful atmosphere.
C. Air-line respirators..	Air supplied from special system or compressed air line to wearer through small diameter high pressure hose, reducing valve, short piece of flexible rubber tubing and face piece.	Against any atmosphere, but should not be used in immediately harmful atmosphere.
D. Abrasive blasting...	Features same as 1, 2, 3 above (3 is more common) but in addition this device has suitable hood to protect wearer against rebounding abrasive.	Same as 1, 2, or 3 above, depending upon features but in addition has protection against impact and abrasion from rebounding abrasive material.

At the present time there has been developed in the United States by the United States Bureau of Mines a very rigid approval schedule for the testing of respirators of all kinds. Out of the extensive studies and tests made by this agency have resulted the standards necessary to determine the effectiveness and suitability of the various types of respiratory protective equipment.

In selecting respiratory protective devices care should be taken to ensure that each device is designed and approved for use against the specific toxic material encountered and under the condition in which it is encountered. No gas mask, chemical cartridge type respirator or mechanical filter type respirator will sustain life in an atmosphere deficient in oxygen, and even supplied-air respirators or hose masks should not be used in such locations unless the worker is protected by a lifeline operated by another worker located in a safe place.

Personal respiratory protective devices must be maintained in a condition that is substantially the same as when received from the manufacturer. Proper maintenance requires a thorough knowledge of the device and should be performed by a responsible person. Failure to keep such devices clean and in efficient operating condition is responsible for much of the resistance of workers to wearing the equipment, and thus for failure to provide the protection intended. Neglect also makes it necessary to replace the equipment more frequently. The equipment should be stored in a clean, dry place where it will not be tampered with and where it will be conveniently available when the emergency arises. Where a good deal of such equipment is in use, it is a good plan to give definite responsibility to one person for the periodic inspection, checking, and maintenance of such equipment. Good rules to follow with regard to the maintenance of respiratory protective equipment are:

(*a*) Always give the same device to the same person.

(*b*) Have a definite place to leave dirty devices and to pick up clean ones.

(*c*) Establish a maximum length of time the respirator may be used before it must be serviced and cleaned, and keep a record of the dates when inspected.

(*d*) Establish a simple effective method of sterilization at regular intervals.

In those cases where workmen have been properly informed regarding the need to wear respiratory protective equipment and have been trained in the proper use of such equipment, very little resistance to the wearing of the equipment is encountered. For this reason it is important that an educational program be inaugurated among the workmen with regard to the acceptance and use of respiratory protective devices. In this case, as with the general use of hygiene in industry, there is a definite responsibility to be assumed by both the em-

ployer and the employee. The employer should understand the operation performed by the workman and the hazards involved. He should be acquainted with the design, use, and limitations of protective equipment. Where such equipment is needed he should provide it and it should be of good and approved quality. The workman should also be instructed personally as to the need for wearing the equipment and how to use it properly. The employer should maintain the equipment in good, clean, serviceable condition, and its use should be carefully supervised. If the employer faithfully and properly responds to these responsibilities, the workmen, on the other hand, should accept the responsibility for wearing the device in the most effective manner. Satisfactory use of personal respiratory protective devices cannot be obtained without this mutual acceptance of responsibility and cooperation.

All too frequently employers are prone to fall back on respiratory protection as the only means of safeguarding the health of employees. It should be considered that, at best, respiratory protective equipment is only a stop-gap, or a temporary means of protection, and should never be employed where other more permanent methods can be used, such as local exhaust ventilation or wet methods as in the case of dusts, supplemented perhaps by general ventilation. It is unfair to request any workman to use a respiratory protective device throughout an 8-hour day, especially in warmer seasons, when even the best devices are uncomfortable and may at times be responsible for skin diseases.

13. *Protective and Personal Clothing and Equipment*

RULE.—*Workers in operations, processes or conditions of work which unduly expose them to dampness and wet environments, excessive heat, excessive noise, hazardous radiations, and other eye hazards, skin irritants, falls, falling material and other hazards, shall be provided with proper protective clothing and other devices of a type approved by the* .....

PURPOSE OF RULE.—Some industrial operations require a potential exposure of the workmen to various hazards. Where protection is not possible by other methods, proper protective clothing should be provided to the individuals so that the exposure will be reduced. The purpose of the rule is to insure that such devices are of the proper type for the exposure and are properly maintained.

PRACTICES FOR COMPLIANCE WITH RULE.—Personal protective devices have been mentioned in the sections on Temperature, Noise, Radiant Energy, and Skin Contact. Further protective devices include those which give protection against falling materials, against splashes of liquid chemicals, against excessive dampness and against falls.

Head protection against falling material may be provided by means of hard hats. Such head gear should be of a rigid material which will

deflect falling objects and will protect the head from the shock from such objects.

Facial protection may be provided by means of goggles, shields which cover the entire head and shoulders or face shields. Such facial protection should allow full vision and comfort. Full head shields may be made of various fabrics with a transparent face piece allowing vision. Face shields may be of plastics which allow full and undistorted vision and which are provided with head band for support or a handle for holding it in position. Goggles may be used for protection of the eyes alone against flying objects, radiation, or splashed liquids. The lenses of such goggles may be of a hardened shock-resistant glass, or of other durable material which allows free and undistorted vision. They should give actual protection against the hazard, and, if necessary, should be of a cup type which closely fits the face to exclude extraneous materials completely.

Protective clothing for the body may include: gloves, armlets, jackets, aprons, or complete body covering such as coveralls. Such items should be designed to protect the parts of the body which may be exposed to the hazard. As a guide for selection of types of materials which best protect against certain types of hazards, the following list of materials is cited: asbestos fabrics—flame resistant; treated cotton fabrics—flame and alkali resistant; chrome leather—heat and flame resistant; woolen fabrics—heat, flame, and acid resistant; rubber—water, acid, mild alkali, and electric current resistant; neoprene—solvent and oil resistant; other synthetic plastics—water, solvent, oil, and acid resistant.

Protection for the legs and feet may be provided by means of leather and rubber shoes and boots and by leggings.

The maintenance of protective clothing and equipment is a very important part of its use. Without proper maintenance such equipment may in itself become a hazard or may completely fail to provide the protection for which it was designed. Furthermore, protective equipment which contacts the body must be kept clean in order not to create a nuisance or any insanitary condition.

As criteria for the selection of protective clothing and equipment, the following items must be considered: (*a*) the equipment should be reasonably comfortable under the temperature conditions in which it is to be used; (*b*) it should fit well and not interfere with the workers' activities; (*c*) it should afford adequate protection against the hazard involved; and (*d*) it should be durable.

14. *Housekeeping*

Rule.—*The housekeeping in all occupied areas shall be such as to promote a healthful and safe environment.*

Purpose of Rule.—Good housekeeping is, through order and cleanliness, an essential factor in assuring a healthful environment.

Practices for Compliance with Rule.—The effectiveness of any good housekeeping program depends in a large measure upon the thoroughness with which each person involved does his part. It is essential that such a program be inaugurated by management and that the workers be trained in their respective duties and obligations in the use of equipment, methods and practices installed for the prevention of health and safety hazards. Another essential in a good housekeeping program is a schedule of frequent inspection to determine the degree of compliance with good practices.

One of the important factors in introducing a good housekeeping program in a plant is the securing of orderliness. The plant should be so designed that the flow of raw materials into it and the various stages of manufacture are arranged in such a manner that no congestion will result. Disposal of scrap and waste material must be adequate. In addition to a well-planned manufacturing process, it is important that proper storage facilities be provided for equipment, tools, and raw materials. Unnecessary equipment and materials should be removed from working floors and surroundings.

Thorough housekeeping means the removal of accumulations of dust from beams, pipes, and overhead structures, from shelving, from open storage platforms and from the top of mechanical equipment. It also means the removal of accumulations of dust and spilled materials from floors. Wherever possible, vacuum cleaning methods should be used. All cleaning should be done outside of working hours, or at such times as will keep the exposure to dust to a minimum number of employees. Workmen engaged in cleaning operations and all others who may be exposed where dust is the offending agent, should be provided with approved dust respirators.

In general, one may summarize good housekeeping for the control of occupational hazards by stating that in the first place it is everybody's job. In simple terms it means maintaining an orderly and workmanlike shop, indoors and out. Some industries have found it useful to make someone in each workroom responsible for the housekeeping in that room. Others delegate that responsibility to shop health and safety committees. Whichever procedure is used, special attention should be paid to the following: (*a*) Tools should be kept in their assigned place. (*b*) Work benches should be orderly. (*c*) Materials should be brought to the operators and stacked in an orderly fashion. (*d*) Floors should be kept free of trash, spilled oil, and other waste. (*e*) Aisles, stairways, and halls should be kept free of obstructions. (*f*) Containers should be kept closed, except when in actual use. (*g*) Windows should be kept clean. (*h*) Lights should be cleaned and bulbs renewed promptly when indicated. (*i*) Safety equipment should be kept in assigned places, repaired and cleaned regularly. (*j*) Plant exterior, yards, storehouses, garages, etc., should always be kept clean. (*k*) Floors and other

places where dust may settle should be kept clean by either wet sweeping or vacuum methods.

15. *Sanitation*

Rule.—*The sanitation within all places of employment shall be such as to promote a healthful and safe environment. No insanitary condition shall exist which may increase the incidence or permit the spread of disease. The handling, preparation and serving of food and drink shall be conducted in such a manner as to prevent the spread of disease.*

Purpose of Rule.—Good plant sanitation is essential in the prevention of communicable and other diseases.

Practices for Compliance with Rule.—Plant sanitation is essentially concerned with (*a*) Water supply, (*b*) Waste disposal, (*c*) Washing facilities, (*d*) Toilet facilities, (*e*) Personal services, and (*f*) Housekeeping. The latter subject has already been treated in this code.

Water Supply.—Every place of employment should have a supply of clean, cool, wholesome and safe drinking water, approved by the local health authorities. The temperature of the water supply for drinking should not be lower than 4° C. nor higher than 27° C. and should be preferably between 7° C. and 10° C. If the water is cooled by ice, the ice should not come into direct contact with the water.

Where sanitary drinking fountains are provided, they should be of an approved type and construction and there should be at least one such fountain for each 50 employees. The common drinking cup is prohibited. Containers for drinking water from which the water must be dipped or poured should not be allowed, even if they have covers. Where water from an unapproved source is used for industrial processes or for fire protection, distinct notices should be posted stating clearly that such water is unsafe for drinking.

Waste Disposal.—Waste receptacles of the type which can be kept clean and sanitary should be provided in all places of employment. There should be an adequate number of such receptacles, and these should be provided in or near all eating places. Receptacles should be covered, unless they contain nothing which will attract flies or rodents. All waste receptacles should be cleaned as often as is necessary to maintain them in a sanitary condition. All waste, including sewage, should be disposed of in a manner approved by the local health authorities.

Washing Facilities.—Adequate facilities for maintaining personal cleanliness should be furnished in every place of employment and should be maintained in a sanitary condition. Separate washrooms should be provided for each sex. At least one wash basin with adequate water supply should be provided for every 10 employees or portion thereof up to 100 employees, and one wash basin for each additional 15 employees or portion thereof. Twenty-four inches of sink with individual faucet may be considered equal to one basin. At least one wash

basin should be provided in each toilet room, unless general washing facilities are on the same floor or near to the toilet room. Where employees are exposed to skin contamination with poisonous, infectious, or irritating materials, then there should be provided for them, one wash basin with hot and cold water for every five employees and one shower with hot and cold water for every 15 employees. The common towel is prohibited. Soap, in a suitable dispenser, should be provided at each wash place. Oils or solvents used for removing contaminants from the skin should be used sparingly.

Toilet Facilities.—Every place of employment should have adequate water closets, chemical closets or privies, separate for each sex, in accordance with the following table in which the number of persons is the maximum of each sex.

Number of persons employed	*Minimum number of toilet facilities*
1 to 9	1
10 to 24	2
25 to 49	3
50 to 100	5
over 100	1 for each additional 30 persons

Chemical closets and privies should not be permitted except where no sewer is accessible and only when they can be kept under careful supervision. An adequate supply of toilet paper in proper holders should be provided in each toilet room. Toilet rooms should be fitted with self-closing doors which should be screened from workrooms. The construction and maintenance of toilet structures should comply with local health authority requirements.

Personal Services.—In all places of employment where it is necessary for male employees to change clothes or where females are employed, separate dressing rooms with lockers should be provided and maintained in a sanitary condition. Dressing rooms should be provided for men whenever the type of work is such that it involves exposure to excessive dust, fumes, heat, vapors and other contaminants.

Retiring rooms should be provided in all places where 10 or more women are employed. Where less than 10 women are employed and a retiring room is not furnished, some equivalent space should be provided, which should be screened properly and made suitable for the use of women workers.

In every establishment where it is inconvenient for the employees to eat lunch away from the premises, there should be provided a special lunch room. No employee should be permitted to eat lunch at his place of work or in the workroom. Lunch rooms should be maintained in clean and sanitary conditions.

C. Medical Provisions

1. *Prevention and Treatment of Occupational Illnesses and Injuries*

Rule.—*Arrangements for facilities and services shall be present for the prevention and the prompt and early treatment of all illnesses and injuries resulting from occupational exposures.*

Purpose of Rule.—The purpose of medicine in industry is to promote the health and physical well-being of industrial employees.

These objectives may be accomplished by:

(*a*) Prevention of disease or injury in industry by establishing proper medical supervision over industrial materials, processes, environments and workers.

(*b*) Health conservation of workers through physical supervision and education.

(*c*) Medical and surgical care to restore health and earning capacity as promptly as possible following industrial accidents or disease.

Practices for Compliance with Rule.—There is no industrial establishment too small to have an organized medical service. This has been definitely demonstrated in many countries where organized medical services have been developed for very small plants, say those employing less than 500 workers, by organizing several small plants in close proximity to each other and furnishing them with an industrial medical service by the utilization of local resources. Without such a medical organization and supervision, additional time is lost from accidental injuries, medical compensation costs are increased, and the establishment itself lacks the supervision and advice it needs in order to have adequate measures for health conservation.

The scope and type of an industrial medical service will obviously depend upon the nature of the industry, its location, and the number of workers. In isolated communities it may be necessary to provide complete medical and hospital service for the workers and their families.

The bulk of industrial medical service in a plant is given in the first aid room or dispensary. In order to maintain an adequate service, an industrial establishment will have to provide itself with one or more well qualified physicians to provide such service in the plant. The number of physicians and whether or not they serve full or part time will depend upon the number of workers in the plant. As previously indicated, small plants may combine to employ one or more physicians, or to secure the services of a group of physicians in the community on a rotating service plan. The dispensary should have one or more full-time or part-time qualified nurses who shall work at all times under the supervision of the physician. In case the physician is not present in the plant dispensary throughout the working period, then the nurse should have written standing orders signed by the physician.

Other assistants, such as dentists, technicians, etc., whether on part-time or full-time basis, shall be employed as determined by the medical director.

Each plant shall have a dispensary of a size and arrangement and with equipment in accordance with the needs of the industry it serves. Detailed information on this score may be found in the references at the end of the appendix.

Some of the functions and services performed at the plant dispensary are as follows:

(*a*) Emergency medical care of all employees who are injured on the job.

(*b*) Continued treatment of employees suffering from occupational diseases or accidents.

(*c*) Maintenance and analysis of all disability records in order to know how, when, and why, lost time due to disability occurs in the plant; these records should be tabulated monthly, according to cause, nature and duration of disabilities, and the department of occupation of the patient.

(*d*) All employees returning to work after an absence due to illness or injury should be examined in order to determine their capacity to work safely and efficiently.

(*e*) The medical department in the plant has an unusual opportunity to promote health education among the employees, since an employee who is ill is in a receptive mood to absorb good health practices.

(*f*) The medical department should cooperate with, and, if indicated, supervise all other services in the plant which relate to the health of the workers, such as food service, welfare service, and recreation programs.

Adequate industrial health conservation depends on cooperation between employers and employees. The medical department should therefore strive to give these two groups the same courtesy and professional honesty as they would to private patients. Industrial nurses and non-professional assistants should be supervised by the physicians, and their duties and functions should be described in clear and concise language, posted in the medical department. The physician should utilize the services of special consultants in the various branches of industrial medicine and surgery and in the control of the working environment. The latter service may be obtained from the .....
.....

Medical and surgical care of the worker should aim to restore the disabled employee to his former power and occupation as completely as science, skill, and nature will permit. It is the physician's responsibility to furnish concise and dependable medical reports promptly to those agencies responsible for the compensation and rehabilitation of the worker.

The early diagnosis and treatment of any injury or disease is extremely important. No attempt will of course be made here to outline the diagnostic and treatment procedures, but it may be well to mention that progressive medical departments have found it useful as an aid in diagnosis and treatment to utilize techniques of clinical laboratories, X-ray equipment and other useful adjuncts in the field of industrial medicine.

2. *Prevention and Treatment of Nonoccupational Illnesses and Injuries*

RULE.—*Arrangements for facilities and services shall be present for the prevention and the prompt and early treatment of all emergency nonoccupational illnesses and injuries.*

PURPOSE OF RULE.—First aid to the patient suffering from a nonoccupational injury or illness will ofttimes permit him to remain on the job and will also serve to advise him regarding the need for outside medical care for an illness or an injury which, if not properly taken care of, may result in considerable loss of time from work.

PRACTICES FOR COMPLIANCE WITH RULE.—Ordinarily a plant medical service should not invade the field of private medical practice by prolonged treatment of nonoccupational disabilities. Exceptions to this statement are those instances where industrial plants are located in isolated communities where no other medical services are available, save those in the plant itself. In most instances, treatment on nonoccupational injuries or illnesses should be limited to what is necessary to keep the employee on the job until he can see his own physician.

3. *Physical Examination*

RULE.—*Every employer shall make available at no cost to a prospective worker a preplacement health examination.*

Periodic health examinations shall be given to all workers requesting such examinations at no cost to the worker. In the case of workers exposed to toxic materials or hazardous conditions of work, such as those exposed to siliceous dusts, heavy metal dusts, or toxic solvents, the workers shall be examined as often as deemed necessary by the examining physician, but such examination must be given at least once a year.

In case the periodic examination shows the worker unfit for further work or for certain classes of work, thereby barring the worker's future employment, then the latter may designate a physician of his choice and request a review of the findings. If the two physicians cannot agree in the findings, then a third physician, agreed on by the two physicians, shall be selected and his findings shall be final. If the two physicians cannot agree on a third physician, then the director of the .... shall make the selection.

PURPOSE OF RULE.—Health examinations in industry are a means to

promote and maintain the physical and mental well-being of the workers. More specifically, the objects of industrial health examinations are:

(*a*) To facilitate placement and advancement of workers in accordance with individual physical and mental fitness.

(*b*) To acquaint the worker with his physical status and to advise him in improving and maintaining personal good health.

(*c*) To safeguard the health and safety of others.

(*d*) To determine and control the effects of unhealthful working environments.

(*e*) To promote cooperative support and understanding of industrial health practices by employer and employee alike.

Practices for Compliance with Rule.—Unjust or questionable exclusion from work through the employer's application of the findings of the health examinations in industry is against the public welfare and is contrary to sound industrial health principles. From the public and industrial health viewpoint, the only absolute bars to immediate employment in nonhazardous occupations are: communicable diseases, mental illness in which impaired judgment or action prevents cooperative effort, and incapacitating injury or disease.

In scope, the industrial health examination should include such considerations as the worker's past medical, family, and occupational history. This latter is extremely important, in that it may throw considerable light on the worker's present physical condition, which may have been impaired by previous hazardous employment. For example, a worker who has been exposed for a prolonged period of time to the inhalation of silica dust may, upon careful physical examination, show evidence of lung impairment, which would preclude his employment in a dusty trade. It is essential, therefore, that the examining physician not only determine from the prospective employee his past occupations, but he should also determine either from the employee or from other sources, the nature of the hazardous exposures which may be associated with the various occupations.

In addition, the examination should include physical findings, personality appraisal, laboratory data, and the physician's summary of findings and recommendations.

One of the important objectives of the industrial health examination is the proper placement of the worker. For this reason, the examiner will find that he may obtain best results when he is thoroughly familiar with the industry he serves and the hazards of the industry. Such familiarity will only be obtained by the physician through periodic inspection of the industrial establishment he serves. Such inspection will also serve to locate hazardous plant conditions which may be in need of correction.

No attempt will be made in this discussion to set forth the equip-

ment necessary to conduct a thorough health examination, nor to specify the routine procedure involved.

It is important, however, to indicate briefly the use to which records of industrial health examinations may be put. In the first place, all major findings should be discussed with the worker, emphasizing the necessity for the latter to obtain immediate and adequate medical care, if this be indicated. A transcript of the record may be supplied to the employee's personal physician, or to an official health agency, on request or consent of the employee. The employer is entitled to receive information regarding the man's physical and mental capacity for work, so that the worker may be readily placed or promoted. A special simple form can be used for this purpose. The employer should specifically be told of any condition or disability found on the worker which may have been caused by the working environment. Governmental agencies which require the results of a physical examination in connection with compensation procedure should be furnished with a report, but only after presentation of a legally enforceable official order.

In all other cases there should be rigid observance of the confidential character of the health examination record and it should not be revealed to anyone except on consent in writing of the worker himself.

One of the most controversial points in labor-management relations in the field of industrial hygiene has been the physical examination. Until recently, neither management nor labor has fully understood how to utilize properly the physical examination as a technique for the improvement of health of the industrial worker. In the past, and in some instances even today, routine preplacement and periodic physical examinations have been made a management requirement, in order to protect it in compensation litigation and to reduce the cost of insurance premiums. Labor, on the other hand, has insisted on contract clauses or laws designed only to protect workers against unfair use of the examination rather than making it a health service to the worker. We must recognize first that the physical examination is more than a medical problem. It is also a socioeconomic problem. The man who has spent his working life in one industry, and has acquired seniority and a higher wage scale cannot be expected willingly to accept placement in a less arduous but less remunerative job, even though it may save him from premature death due to a health condition discovered in the examination. Enlightened employers recognize this problem even though they have not yet provided the answer. These problems can be solved if all interested groups get together and put their minds to it. The above rule dealing with the subject of physical examinations is, in the opinion of competent authorities, workable, and is an enlightened approach to this problem. Certainly that portion of it dealing with the review of a periodic physical examination is reasonable and it should serve to protect both the employer and the employee.

The purpose of periodic health examinations is to assist in maintaining the health of the worker and to assure that his physical condition is compatible with the requirements of the job. For these reasons periodic physical examinations should be made with sufficient thoroughness and frequency, so as to permit early recognition of disease while it is still in its incipient stage. Such examinations are especially indicated for personnel in key positions and in the adult age group.

For those workers who are not exposed to hazardous conditions, an annual physical examination should be sufficient. On the other hand, there are many industrial operations and exposures which require more frequent examinations. Although in the final analysis, the frequency with which examinations are made will depend in a large measure on the judgment of the examining physician who, it is assumed, will have a thorough knowledge of plant conditions and exposures, certain experiences have led to uniform practice in the matter of physical examinations for workers exposed to toxic substances.

These workers exposed to solvents, such as carbon tetrachloride, benzene and toluene, should be examined at the beginning of exposure and thereafter once a month. This monthly examination, however, need not be a thorough one, but only one which will indicate any early signs of poisoning. If good engineering practices are in vogue and if exposures are slight, then the examination need only be every 3 to 6 months. Similarly, workers handling in any phase, compounds of lead, arsenic, mercury, cadmium, antimony, manganese, or other highly toxic material should be examined at least every 3 to 6 months. Workers exposed to mineral dusts such as silica, asbestos, etc., should be examined at least once a year, and this examination should include an X-ray, preferably 14 by 17 inches in size.

Workers exposed to radiation, such as from X-rays or radium paint, should be examined every 6 months.

The examining physician will acquaint himself with the early diagnostic procedures for all of these highly toxic materials, so that his periodic examination will be directed specifically toward the search for any deleterious effects which the exposure may have on certain organs of the body. For example, in the case of exposure to radium there are now available sensitivity tests to determine the amount of radium ingested by the body. Blood studies may be utilized for these workers exposed to certain organic solvents. Certain precise criteria are available for determining if injury is resulting from lead exposures and for many other of the heavy metals.

In closing this discussion of preplacement and periodic physical examinations, it is essential to reiterate the objective of the examination, which is to utilize every available worker. The old idea that an industrial worker must have the physical requirements of a military applicant is outmoded. Recent experience has demonstrated in no un-

certain terms the fact that people with certain physical handicaps can perform useful work. A new concept has emerged from the intensive study of jobs and workers, and from the results obtained in the placement of the handicapped, by the rehabilitation clinics in highly industrialized countries. A new and positive approach has been developed which has made it possible to employ men and women with all types of physical handicaps. It has stimulated the use of scientific methods for assessing the capacities of the individual, the limitations of the job, and the means for matching the two. In this connection, applicants found infected with syphilis should be employed, provided the disease is at a noninfectious stage, and they have no other disqualifying complication, and that they remain under treatment.

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